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How Chrysler Makes "Floating Cushion Wheels"

INDEPENDENT wheel suspensions for the new Dodge and Plymouth cars are made at the New Castle, Ind., plant of the Chrysler Corporation. This plant has been re-equipped to a considerable extent to handle this work. The main object of this new equipment is not only to make possible the production necessary to meet the growing demand for these cars, but especially to insure accuracy and uniformity of the product.

The wheel suspensions used, known as "Floating Cushion Wheels," are of what has come to be known in the trade as the "wishbone" type. A little study of the assembled construction in Fig. 1 will show the reason for the name given. The small or upper wishbone carries the hydraulic shock absorber and is supplied complete by the maker of the hydraulic unit. The largest single piece of the new construction is the large, or lower, wishbone and this involves several operations which are of special interest.

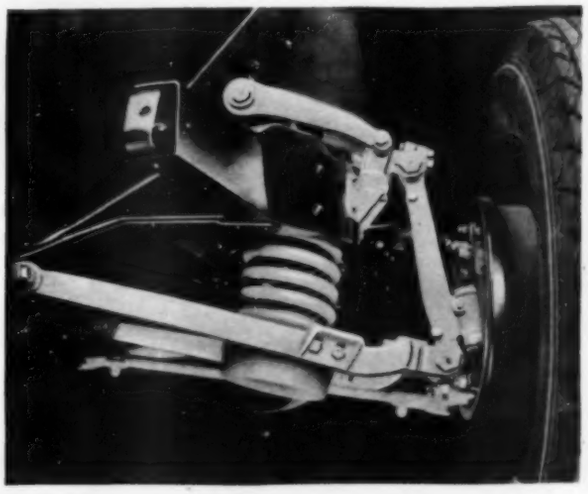


Fig. 1—This combination of wishbones, shock absorbers, steering knuckle and spring give the "Floating Cushion Wheel" action

As with all important parts of the modern car, the wishbone is made of a standard alloy steel to secure the strength and reliability necessary in such vital parts as the front-end mechanism. The wishbones are received from the steel mill rolled to a special shape which can be partially seen by the piece in the press in Fig. 2. Being received in this shape, with the metal gathered in the right places by the rolls in the mills, the work of forging is greatly reduced.

After being heated in modern furnaces, the bar is placed in the press, Fig. 2, and bent around the form *A*. The bar is straight when put in the press, which has been stopped almost at the beginning of the bend. The center ram holds the middle of the bar against the lower end of the form while the two side rams continue their stroke. Both of these rams are linked to the bending arms, both of which are pivoted in the center ram as shown. The form *A* is also forced down by the upper ram, which has a short stroke as indicated by the oil on the ways at *B*. The bending is, in this way, divided between the three rams, all of which are operated by compressed air. After the pieces are bent the wishbones go to the forging press where they are forged to size.

From the forging presses the wishbones go to the heat-treating furnace in Fig. 3, which shows three lines of forgings going through. The pieces are hung on carriers at the end of the furnace and fed through automatically. The movement of the forgings through the furnace is timed to keep them in the heat for the proper length of time. At the discharge end of the furnace is the Gogan indexing quenching machine, Fig. 4. This carries clamping dies which hold the wishbones against distortion while they are cooled in the tank shown.

The operator at the discharge end of the furnace places the heated forging in the lower cooling dies, the upper die clamps it and the whole unit is submerged in the cooling liquid. The quenching machine then indexes, the cooled wishbone is taken out and one right from the furnace is put in its place, to remain during one revolution of the machine, which is timed to give the proper time in the cooling bath.

From here the forgings go to the

drawing furnace on another conveyor after which they are pickled to remove any remaining scale. The pickling is done in a special room in which an air-operated merry-go-round, Fig. 5, dips the baskets of forgings into the acid and cleaning baths in their proper order. This gives a good idea of the five-armed device which supports the trays, lowers them into the tanks and also indexes them to secure the proper sequence of operation. There are four tanks, the fifth position of the arm taking care of the trays at the loading and unloading position. This device makes it possible to handle large quantities of work in a small space and the forgings are then in excellent condition for machining without damaging cutting tools by forging and heat-treating scale.

The first machining operation is the drilling of four holes for riveting the spring seat in position near the narrow end of the wishbone. The spring seats are of sheet steel, drawn into a sort of annular cup to receive the end of the spring and with the center punched out to hold the rubber cushion that goes inside the spring. Four rivet holes are also punched at the same time to match the wishbone. Cold riveting of the spring seat to the wishbone follows, this being done at one stroke of a press. Then, after inspection, the wishbone goes to the first of a series of surface broaching operations, these being not only of interest but indicating the progress that has been made in equipping this plant with modern machinery.

The first broaching is to surface both sides of each end of the wishbone as in

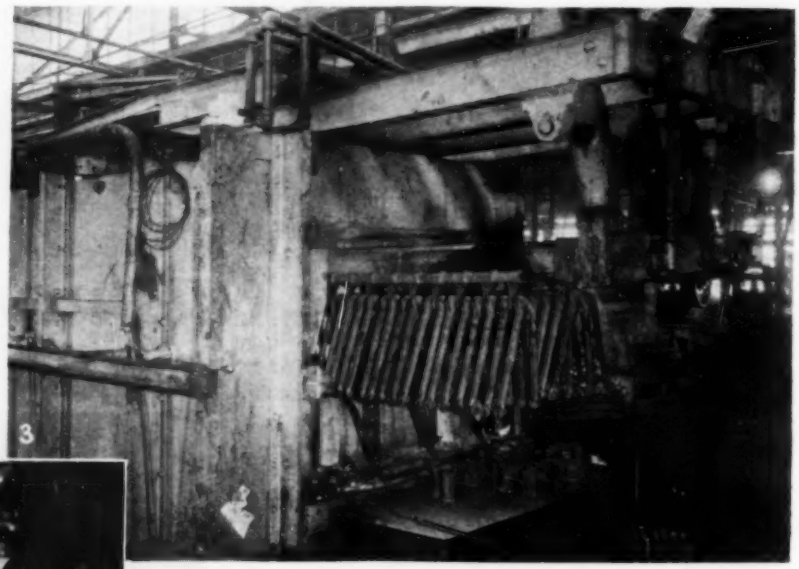


Fig. 3—Continuous furnace for heat-treating the wishbones as they come from the forge. Automatic feed secures the desired heat

Fig. 2—Bending the wishbones before they go to the forging hammers. Specially rolled bars are preshaped by air-operated rams

Fig. 4—Station-type quenching machine at end of heat-treating furnace. Air-operated dies hold the work in shape during cooling

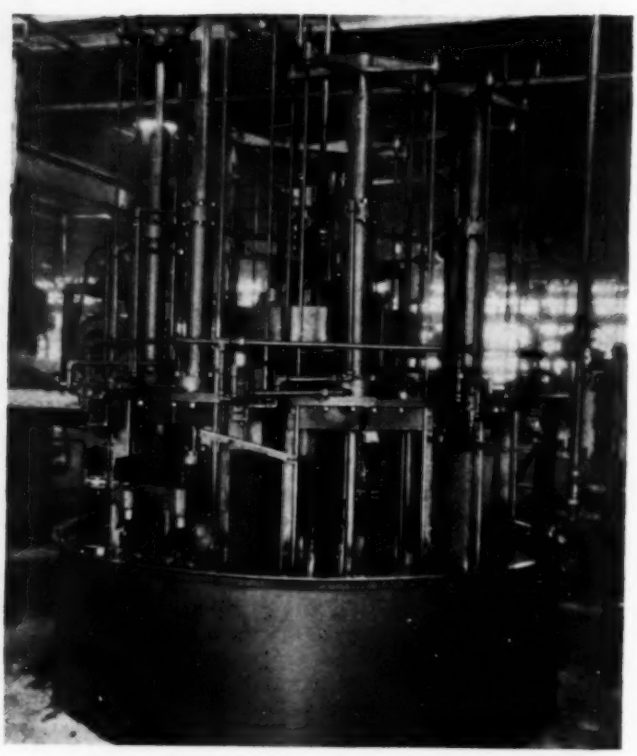


Fig. 6, which is an Oilgear machine. The work is held in a simple fixture which locates both ends with relation to the center and clamps each side independently by arms that are operated by cams at the outer ends. In the meantime the front end is centered by the lever shown. When locked in position a single stroke of the broach finishes both surfaces on each arm of the wishbone to the finish thickness, and after another inspection these ends are drilled in the two-way Natco machine, Fig. 7. This view also shows a section of the new conveyor line that will handle the wishbones, three deep, on the double hooks seen at *A*.

This machine carries the work in nests of three, on each side of a square turret, the three pieces overlapping and the ends being centered in V-blocks and held against the drilling pressure by screw jacks operated by small spoked wheels as seen at the top of the work holder. The small end of the work is held by suitable latches, two of which go through the hole in the spring support. There are three sets of three spindles each at both ends of the machine. These drill and ream both ends of the wishbone before the turret comes back to the loading position.

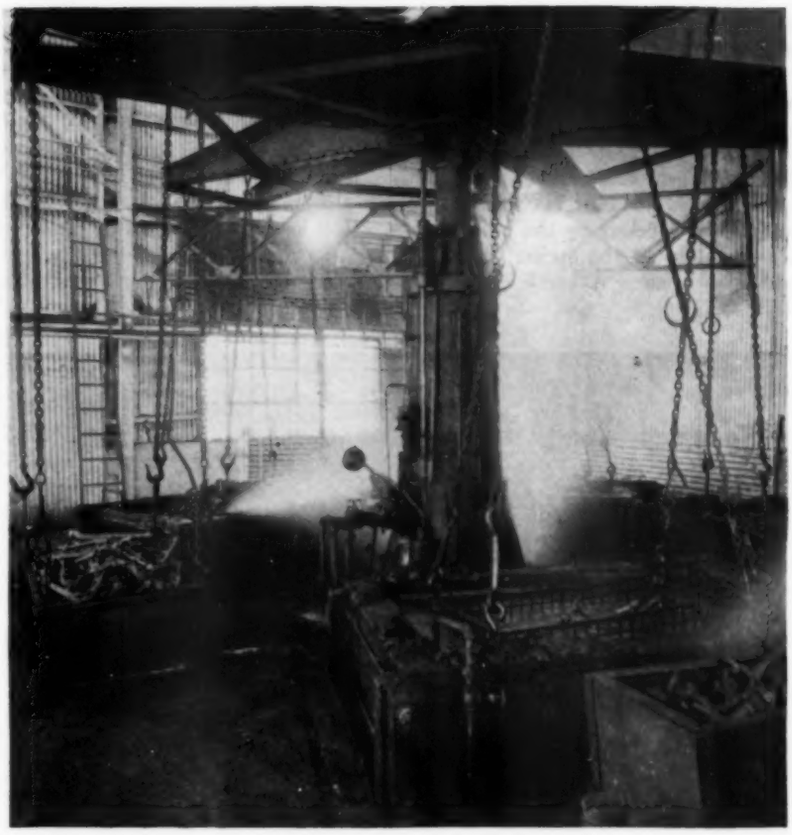
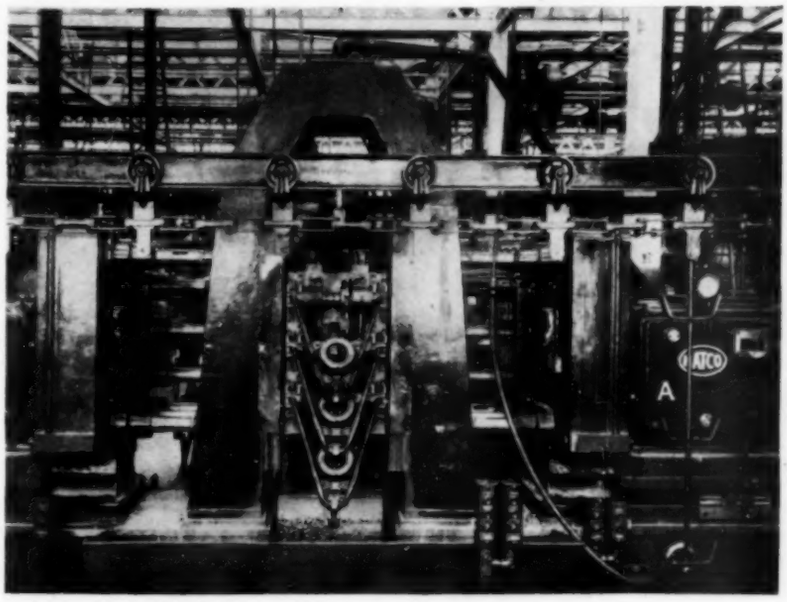


Fig. 5—Merry-go-round type of hoist that handles forgings during the pickling process. Five arms serve four tanks and the loading station in compact space

Fig. 6—Broaching four surfaces at both ends of the wishbone in a single operation. Fig. 7—Drilling and reaming three wishbones at each station in special machine beside conveyor line



After another inspection the oil holes are drilled and then both end holes line reamed, as in Fig. 8. These reaming machines are simple in design and construction, using two ground steel round bars for guiding ways. The wishbone is supported on a triangular frame, backed with a shield to prevent splash of the cutting compound used.

The carriage of these reaming machines is hydraulically operated by the cylinder *A*, beneath the spindle head that drives the reamer. It will also be seen that the ends of the wishbone are held in troughs at each end of the carriage. These troughs keep the cutting compound in the holes being reamed. The supply pipes for compound can be seen at each side. The sides of the troughs carry the bushings which guide the reamers. Each machine is self-contained with motors for the various functions.

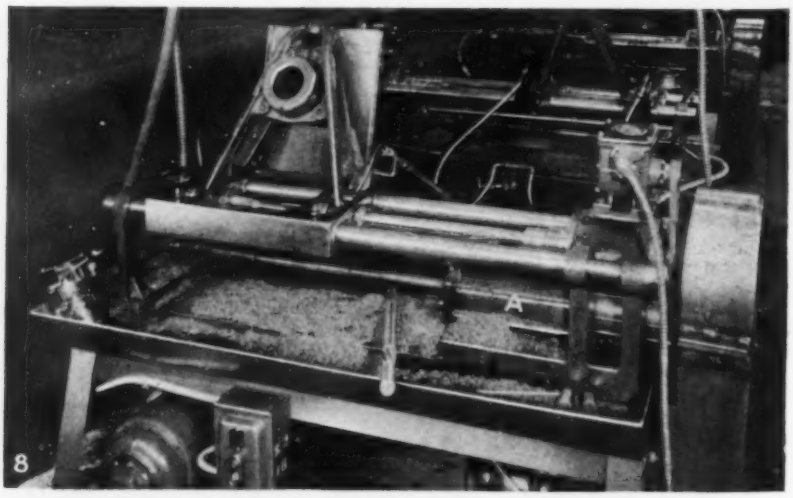
The end or central hole is drilled and faced in another machine with the wishbone located from the end holes. Following this is the broaching of the inner end of the hole just drilled, after which the bushings are pressed in the ends, the whole assembly is washed, cooled and the completed wishbones are

then given a final, thorough inspection in the fixture in Fig. 9.

The holes in the ends of the wishbone are slipped over studs at *A* and *B*. The slide at *C* checks the length of the end boss and prevents side movements. Plug *D* then checks the hole in the upper end while the side surfaces at *E* and *H* are checked by the plugs shown. The position of the spring seat is also tested by gage. A small central plug fits into a hole in the fixture while the large plug goes through the hole in the spring seat and the outer pins check the width of the recess for the end of the spring in the seat itself.

Another interesting operation is the broaching of the jaws of the yoke that carries the lower end of forging on which the steering knuckle rests and hinges. This can be seen in detail in Fig. 10. These yokes are, of course, of drop-forged alloy steel to insure strength and reliability. The stem is machined on a New Britain chucking machine equipped with hydraulic chucks for holding the work. After grinding the stem on a centerless machine the jaws are broached on a new American rotary machine, Fig. 11. Fig. 10 shows how the yokes are located by the stem, and so clamped by the handle on each chuck that the thrust of the cut is taken by the heavy support behind each ear. In addition to the clamping action of the chuck, the curved jaws in which the yoke rests holds it securely in its seat. Cutting compound is made to flood the broaches and the work by means of the hose leading into each broach holder. As will be seen, the work is divided among three sets of broaches.

Following this, the pin holes are drilled in the ears and reamed and spot faced at the same setting. One ear is tapped for the clamping bolt and the cotter pin hole is drilled in a special machine that handles six pieces at each setting. Final machining is the threading of the end of the stem for the nut that holds it into the wishbone, on a Landis threading machine. After washing in the regular way with a hot cleaning solution, the yoke is ready to go to the assembly line. Extensive care marks every step in the manufacturing line so as to insure safety as well as satisfaction in the new floating cushion wheel suspensions.



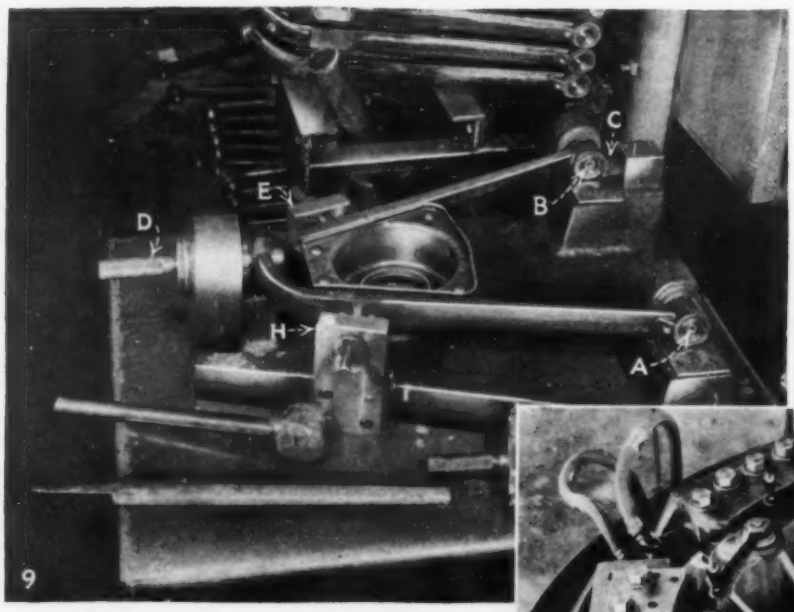


Fig. 8—Special reaming machine with air feed for its unusual work carriage. Fig. 9—Fixture for final inspection of all holes and surfaces before wishbone goes to assembly.

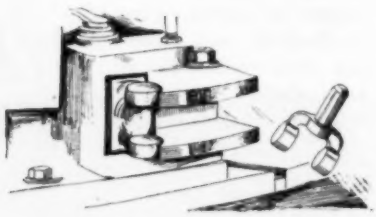
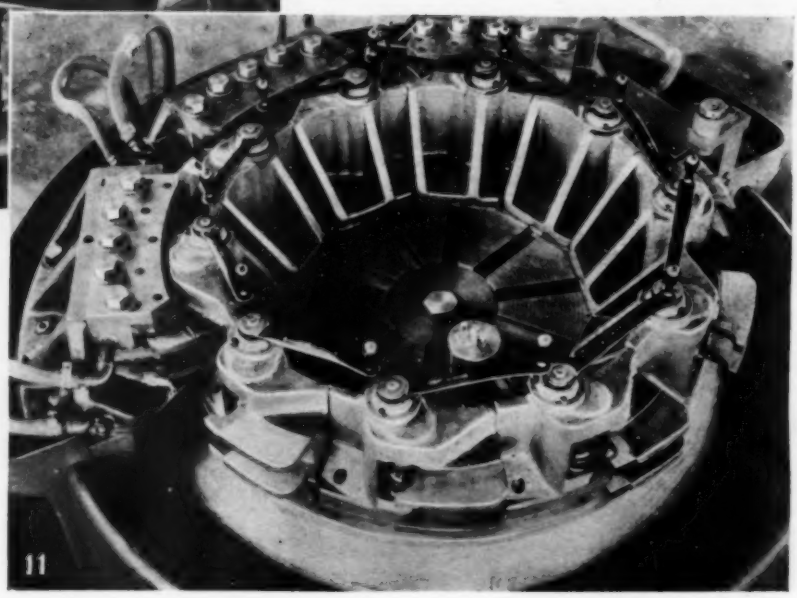


Fig. 10—Yoke for end of wishbone and the fixture in which it is broached. Fig. 11—Circular broaching machine for continuous operation with its three sets of broaches



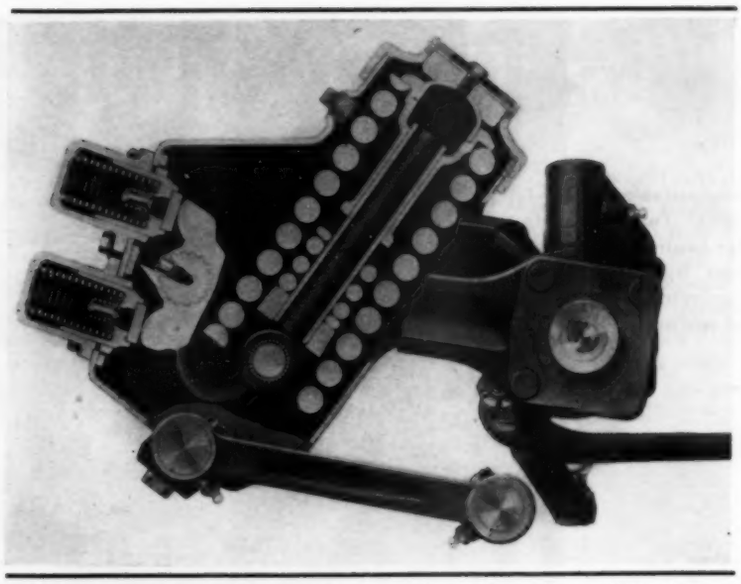


Fig. 1—Section of "knee action" used on Chevrolet and Pontiac, showing operation of suspension springs and shock absorbers

"Knee Actions" for Chevrolet and Pontiac

DIFFERING materially from other front-wheel suspensions so far in use in this country, the type on the Chevrolet and Pontiac cars is self-contained and turns on a king pin at the end of a forged connection at the chassis front-end assembly, the same as the regular steering knuckle. Briefly, the unit consists of a coil spring and a forged lever arm that carries the wheel on the outer end with the other end against one end of the spring, which permits free and easy action of the wheel as it rolls over obstructions or drops into holes. Included in the mechanism is a double hydraulic shock absorber that cushions the spring movement in both directions, the whole mechanism being inclosed in an oil-tight case of pressed steel. A general idea of the mechanism many be had from Fig. 1.

The coil spring is a new problem in automobile work. Material specifications are very exacting, the analysis being, carbon 0.55-0.60; manganese 0.80; phosphorus 0.04 maximum; sulphur 0.05 maximum; silicon 1.80-2.20. The tensile strength is 190,000 lb. and the minimum elastic limit is 175,000 lb. These springs are made of hot-rolled bars, which have been sized by one cold rolling to 0.7035 in. Rods are cut 93½ in. long and centerless ground to 0.6875 in. Each bar is inspected for nicks or scratches and rejected if any are found, because such defects tend to start fractures when the spring is subjected to service. The bars are then heated, pointed at each end and the springs wound on the special machine, Fig. 2. The mandrel is plain and simply determines the inside diameter, the pitch of the coils is fixed by the deeply threaded guide roll in front. When the end of the spring goes around the mandrel it is forced down by the heavily loaded roller at *A*. Withdrawing the mandrel drops the spring into the pan beneath, after which the mandrel is returned for winding the next spring.

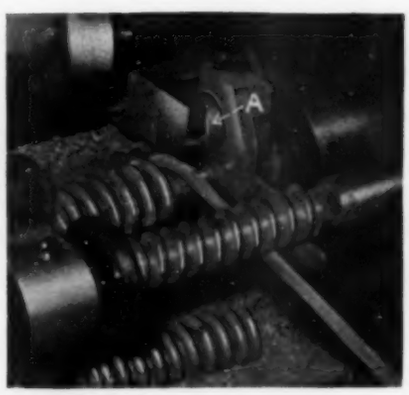


Fig. 2—Guiding suspension spring on plain mandrel which can be easily withdrawn

Springs are placed in separate cradles on a chain conveyor which carries them through a furnace held at 1,600 deg. F. From here they go to a 12-sided, semi-automatic, oil-quenching machine, Fig. 3. Here each spring is clamped firmly to maintain shape and size before it is quenched. Drawing at 950 deg. F. relieves the stresses, after which the spring is cooled in water. The finished spring is 9⅛ in. long without load and has 10½ to 11 coils.

A 16-station grinder, Fig. 4, built especially for this job, grinds the ends flat and parallel in two passes. They are then Brinell tested and cleaned with a shot blast which scours the entire surface. Load testing follows, for total compression to 8 in. under 2,620 lb., and then under a load of 1,520 lb. for checking the compression per inch.

Butt-welding requires mating surfaces to present the same area. So the king pin yoke is extruded, as in Fig. 5, to suit the opening drawn in the housing for the coil spring. This extrusion presented several problems as the forging is of chrome-nickel steel and required special dies and plenty of power. The wall of the housing is ⅛ in. thick. The housing itself is seen in Fig. 6, the entire mating surface being welded at once. This housing incloses the spring, the portion of the wheel arm which compresses the spring and the hydraulic

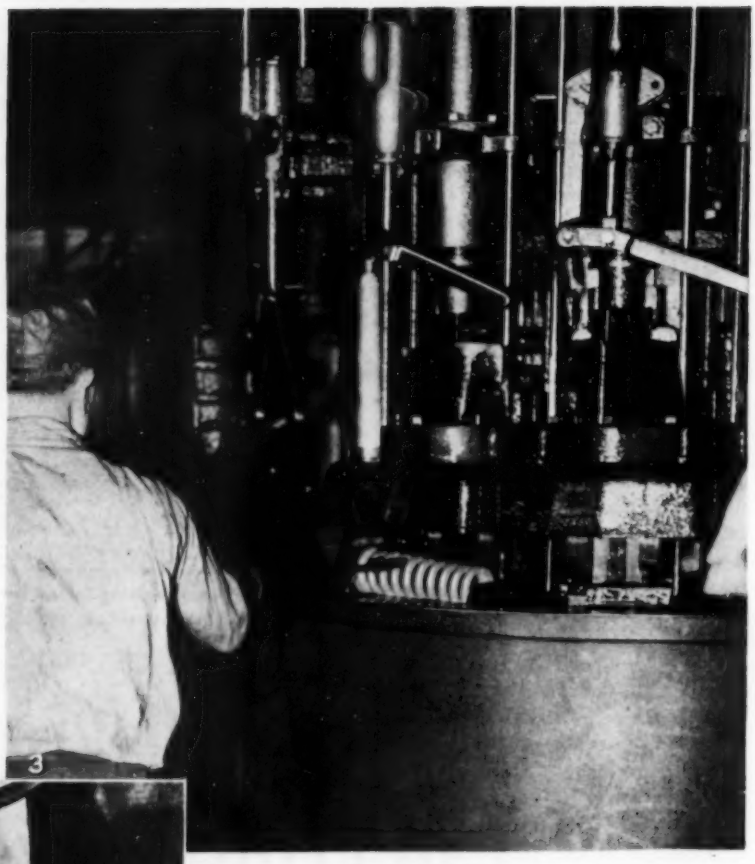
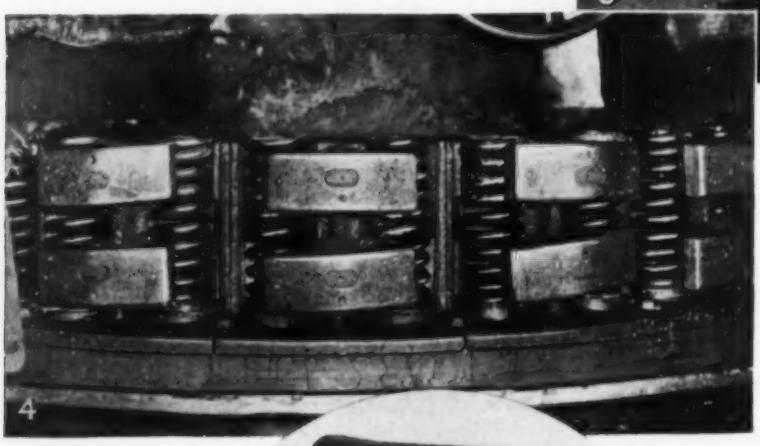


Fig. 3—Semi-automatic, 12-station machine for quenching springs after heating for temper. Each station has air-operated dies that prevent distortion as the springs cool

Fig. 4—Section of 16-station machine which grinds ends of springs. Each station holds two springs by clamps that are easily operated. Fig. 5—Steering yoke forging extended where it is to be welded to housing



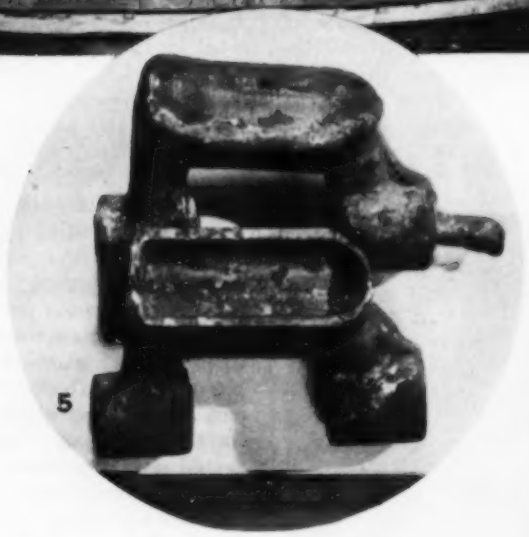
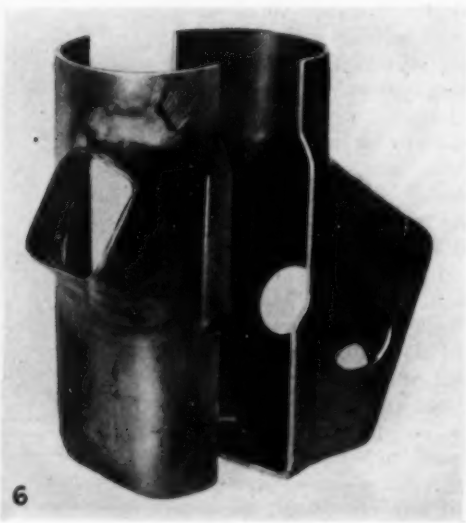


Fig. 6—Both parts of 5/32 in. steel housing. The main seam presents a long weld and the side opening receives the yoke. Bearings are welded in the small openings



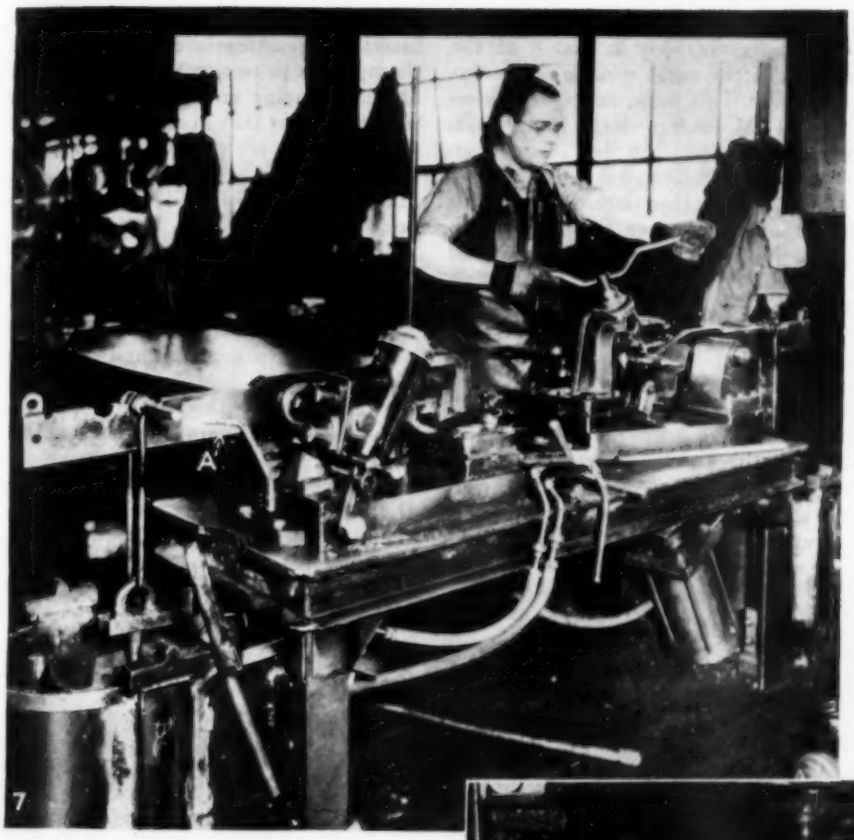


Fig. 7—Testing suspension springs and setting them to give the desired deflection. Air cylinders and known weights are both used in loading springs. Indicator at *A* shows when adjustment is correct

Fig 8—Entrance to spraying and drying oven where complete front-end unit is finished on its way to the freight cars for shipment to assembling plants at any point

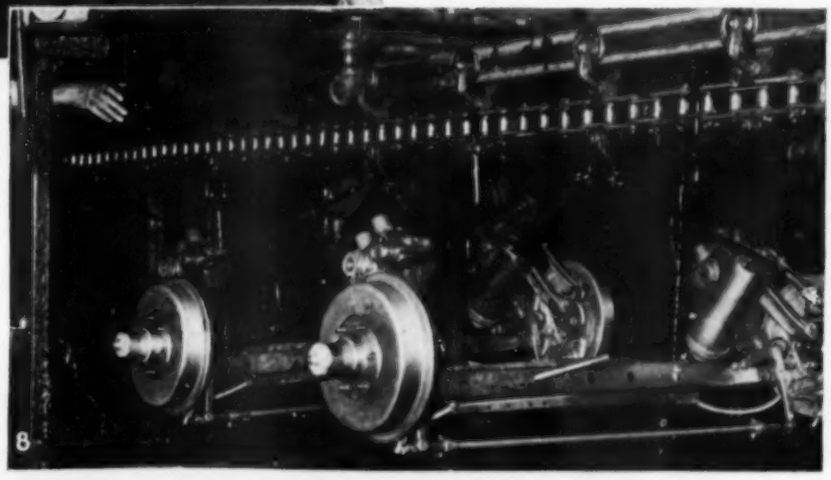


Fig. 9—Welding the forged wheel supports to the pressed steel cross-member which ties them together and by which they are bolted to frame. Squareness of yoke is tested in frame at the left

shock absorbers, the whole mechanism being inclosed in oil.

Bushings which form the bearings for the cross shaft are welded in the housings in a special machine. These bearings, which are of hard alloy steel, are finished by rolling burnishers after the bushings are in place. They thus receive a polish equivalent to that obtained by extended use. Needle bearings are used on the cross shafts. This method of finish is believed to give a harder, and consequently a better wearing surface than can be obtained in any other way.

After assembly each unit is tested on the double-ended test stand, Fig. 7. After being clamped in position the spring is fully compressed by an arm cylinder which acts in addition to a 700-lb. weight on the lever arm. Then the weight alone is used and the spring setting corrected until the pointer *A* shows the correct compression. This adjustment is secured by tightening the spring seat with the wrench shown. The total spring travel is $1\frac{13}{16}$ in. which gives 6.8 in. of wheel movement. Both wheel suspensions, including brake drums, together with the cross piece which connects them under the frame, are assembled as a single unit which can be bolted to the frame either in Detroit or Timbuctoo with the assurance that it will function equally well in either place. These units are seen in Fig. 8 at the one end of the paint spraying and drying ovens. This same conveyor carries them to the loading dock, from which they are loaded into box cars when routed for one of the assembly plants.

Among the other interesting operations that give a more complete understanding of the changes in front end construction are the welding of the king pin support yokes to the cross member in Fig. 9. Squareness of the yoke with the cross member is checked on stand at the left. This cross member bolts under the frame and replaces the forged axle of older design. Some idea of the rigidity of this new construction can be had from the effort necessary to correct any slight misalignment after the yokes are welded in place. It takes a husky man at the end of a long bar to move the yoke. Fig. 10 shows the fixture. The gage is shown at *A*.

The fixture for holding the stamped cross member is also of interest. The inverted U castings are surfaced inside the uprights to receive the jaws *B* which fit the stamping and prevent distortion of the portions that fit the frame. These clamping jaws are positioned by tongues that fit the grooves in the uprights. Simple taper keys hold the clamps in position.

In Fig. 11 is an interesting view of activity in the department which sends parts of the new wheel suspension to the assembly line. The conveyor is shown turning a sharp angle around the guide rollers. Springs and some other parts are hung on rods that project from the conveyor. Other parts are in trays that hang, three deep, in a suitable yoke. As the conveyor passes the different bins the necessary parts are put in place by the men in charge. In this way the assemblers get material as they need it but are not bothered by an oversupply. This illustrates concentration of parts supply in the modern plant.

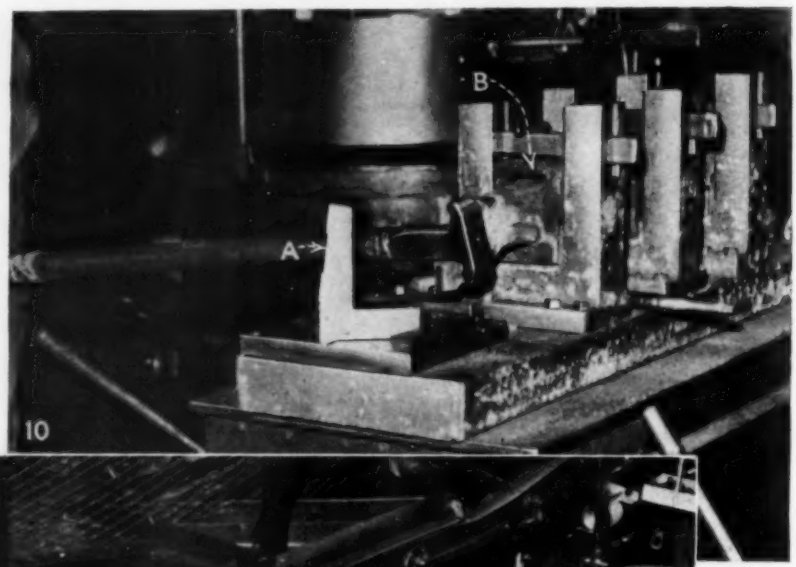


Fig. 10—Correcting any slight misalignment of supporting yoke after welding. Cross-member is firmly held in forms by wedges. Fig. 11—Supply section where wheel suspension parts are grouped to go to assembly lines

Milling Operations on the Wright "Cyclone"

SINCE the Wright brothers made their first flight under controlled power over 30 years ago at Kitty Hawk, phenomenal strides have been made in aviation. A comparison between the original Wright plane and a modern air liner testifies to the great advance that has been made within a single generation.

Less spectacular perhaps but none the less vital to our present civilization is the progress that has been made in manufacturing methods during the same period. Our technique in cutting and forming metals has made possible not only modern transport and military planes but all other phases of mechanical progress as well. Aviation is still in its infancy and is growing rapidly; as it advances shop methods must keep pace by achieving new standards in accuracy and economy.

Modern shop practice combined with engineering skill has created the 750-hp. Wright Cyclone engine which powers a large number of our airplanes. The story behind this engine is one of painstaking detail, but it is only by such means that the exacting requirements of this industry have been met.

In the making of the Wright Cyclone, a nine-cylinder radial engine, milling plays an important part. This article gives a few typical examples with special reference to the jigs employed to clamp and position the work.

One of the most fertile fields for milling lies in the machining of the connecting rods. These consist of one master and eight articulated or link rods. On the master rod there are 27 milling operations and on the link rods 17.

The rods are chrome-nickel-molybdenum alloy steel forgings. In general the sequence of operations is to slab mill the edges, straddle mill the ends, drill the holes, mill the sides, mill the channels and mill the ends. After these roughing operations the rods are heat-treated. Then finishing cuts are taken which are practically duplicates of those used in the roughing sequence. Milling cutters are of high-speed steel with helical flutes.

After drilling, the holes are used for locating the rods for most of the subsequent milling operations. In controlling the milling cuts it is necessary to meet specifications as to weight as well as to size. The rods must be kept within a limit of plus or minus 0.03 lb.

An interesting set-up is that shown in Fig. 1. The operation is that of milling channels in articulated rods for the desired H-section which gives high strength in proportion to its weight. A double-end special Cincinnati machine is used.

The end of the rod is placed over a fixed plug in the fixture. A loose plug is put in the hole at the opposite end and rests on a U-shaped parallel which locates the rod horizontally. A small knob, shown at the rear of the machine clamps the rod down on the parallel while another knob at the front secures it laterally against a locating face. The two small knobs which may be seen below the milling cutter are then turned to bring up plugs to support the rod at two points between the ends. This insures that the rod is held without distortion during the cut. Then the large handwheel is used to complete the clamping

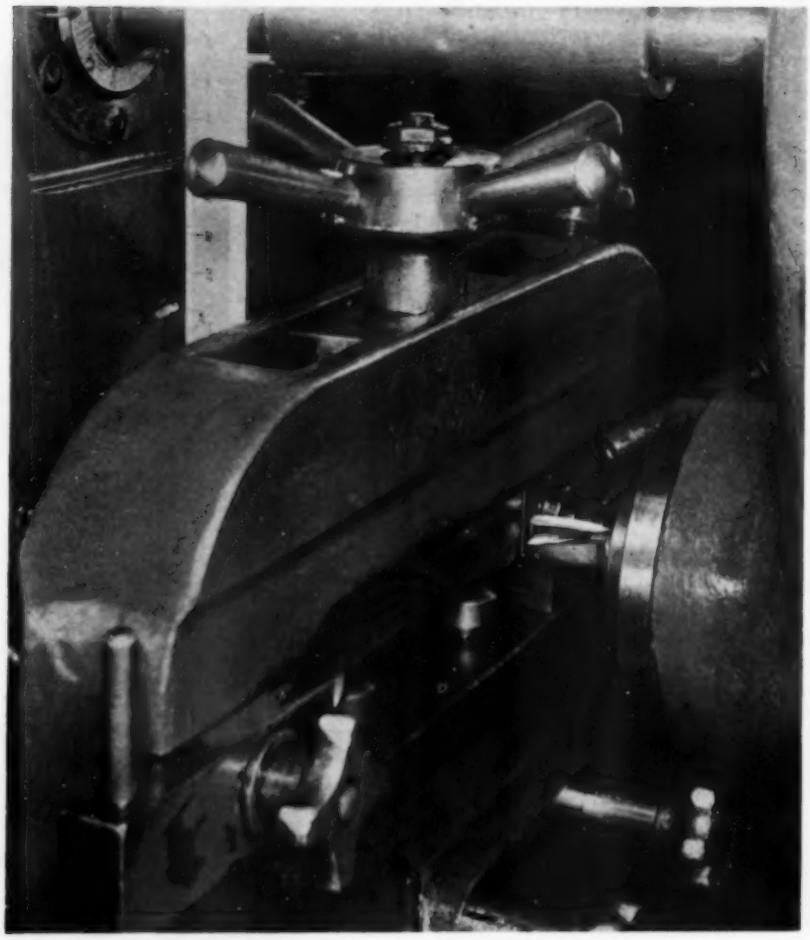


Fig. 1—Link-rod channels are milled on a double-end machine of special design

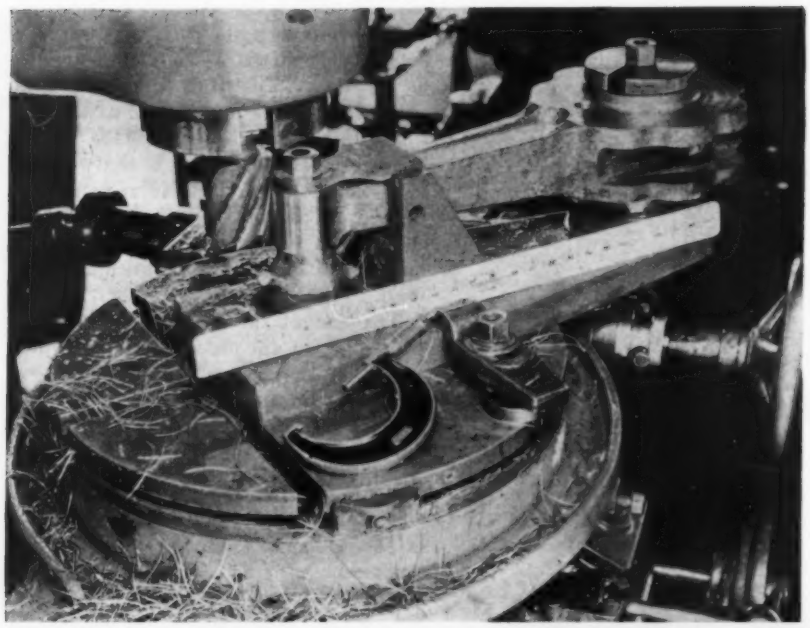


Fig. 2—A circular table with rotary feed is used to machine the outside of the rod ends

by bringing two buttons locating on an equalizing arm in contact with the upper face of the rod directly over the supporting plugs.

The feed of the two spindles is controlled simultaneously either by power or by hand. A splined sleeve, partly visible at the top of the illustration, gives a visible indication of the depth of cut.

To give the desired form to the channels the 1-in. end mills taking the cut are radiused. They are first fed in by hand to full depth at one end and then at the other before the transverse cut is taken. If the cutters are sunk in at one end only they tend to run out slightly when run against the solid shoulder at the opposite end of the channel and cause a widening of the cut at that point. Heavy streams of mineral lard oil on both cutters prolong the life of the tools and keep the work cool.

For the main rod the practice in milling channels necessarily differs from that used on the link rods because its design calls for a tapered channel. One main rod channel is milled at a time, but by means of a carefully designed fixture it is possible to machine each channel in one setting. The rod is mounted on vertical pins set in a plate. Directly under the pin which locates the piston end of the rod, this plate is pivoted to the fixture base so the other end may be swung in an arc by means of a worm and wormwheel segment. Stops are provided to limit this movement to the desired angularity. After the ends of the channel are milled to depth, a cut is taken with an end mill, up one side of the channel, the fixture plate is swung and another cut is taken down the other side. Then the rod is turned over and the operation completed on the other side of the rod. The stops are set to give the channel the taper called for in the drawing. A vertical Milwaukee mill is used on this work.

The same type of machine provided with power rotary feed is employed to mill the rod ends. Fig. 2 shows the machining of the outer radius on the piston end of the master rod. A coarse-tooth, helical, high-speed steel milling cutter is used. The work is again located on two plugs in a special fixture clamped to the milling machine table. Two studs fixed in the center of the plugs furnish the means for clamping the work. The collar under the small end of the rod is adjustable in height

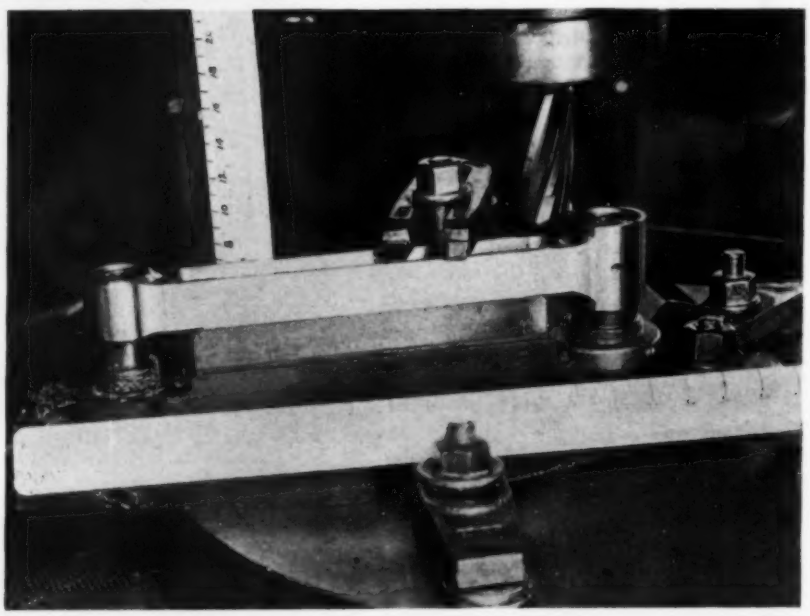


Fig. 3—A formed cutter performs the milling operation on the inner fillet

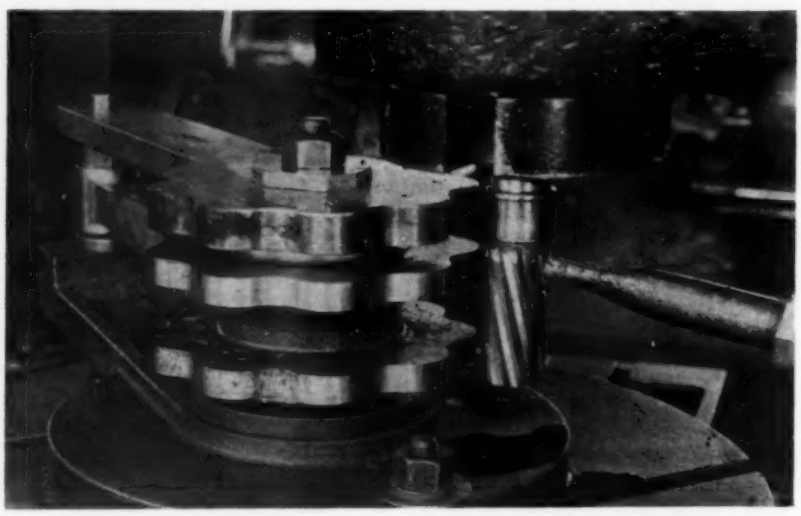


Fig. 4—For machining the lobes the table is guided by a master cam

to give support without springing the work. The cut is taken with power feed after which the table is returned to its starting position by power rapid traverse. Although only the roughing cut is shown the long even chips and smooth finish are readily seen.

Table stops are set from the gage shown above the rod using a $\frac{5}{16}$-in. feeler between it and the cutter.

Both ends of the link rods are similarly milled on the same type of fixture. After each end is machined on the outside radius a cut is taken on the inner $\frac{1}{4}$-in. fillet with a form cutter as shown in Fig. 3. With the rod in the position illustrated the center plug is a push fit while the other plug is relieved at the ends to provide lateral location only. A solid base backs up the center section of the rod and the end supports are adjustable in height. An ordinary U-clamp holds the work. When one side is finished, the rod is turned over on the fixture and the other side machined. Then the fixture is turned end for end and reset by means of a hardened steel bushing in the center of the rotary table. In this position of the fixture, the small or knuckle-pin end of the rod is machined. It will be noted that this end has a double radius which is cut in one operation with a special cutter.

However on the main rod a different method is employed to machine the holes in the piston end. The machining of this part is done with a hollow mill built up of inserted teeth. A pilot guides the cutter and holds it central with the work. In taking this cut the spindle is simply fed vertically downward against the rod.

The large end of the main rod has a scalloped profile to accommodate the knuckle pin holes for the link rods. This profile is formed as illustrated in Fig. 4. Again the work is mounted on a circular table and located from the pin holes on a special fixture. The contour is formed from a master plate with which a follower roll on the cutter is held in contact; the diameter of the roll is 0.120 in. smaller than that of the cutter. Power rotary feed is used at $3\frac{1}{8}$ in. per min. while the master cam is kept against the tool by hand operation of the cross feed screw. The nut on this screw is kept loose so the set-up will ride against the follower on the upside of the lobes. A slight pressure on the feed handwheel keeps the master against the tool on the down side. Two master plates are used, one for roughing and one for finishing after heat-treatment. The weight tolerance of the master rod is also maintained by this operation.

Between the two lobed flanges on the main rod a series of flats are machined to provide the clearance needed for the link rods when they are assembled. The work is done by means of an end mill on a No. 2 horizontal Cincinnati milling machine. Eight flats are machined and these are spaced by a fixture which is indexed for each cut. The rod is located from one of the knuckle pin holes and from the lightening hole, which is the small hole at the end of the channel. A latch at the side of the fixture releases the upper plate for rapid indexing between cuts.

For the finishing cuts on the rods the same fixtures are used but the feeds are lighter because of the added toughness of the material after heat-treatment, the need for a high degree of precision and a smooth finish.

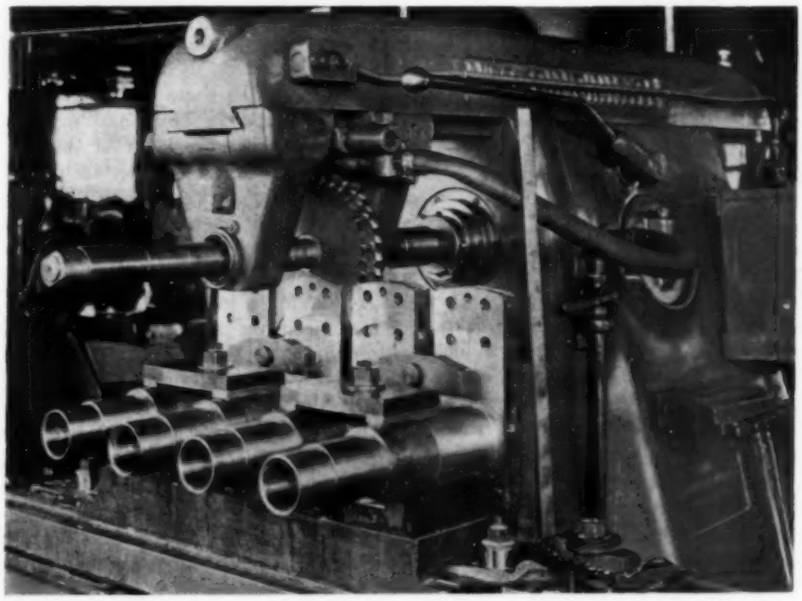


Fig. 5—Crankshafts are ganged in sets of four to mill the counterweight slots

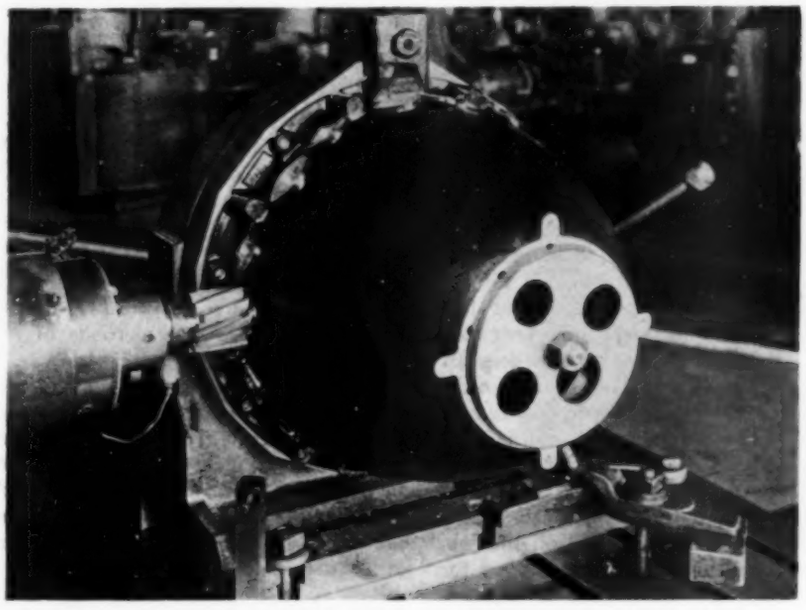


Fig. 6—Valve tappet guide pads are finished on an indexing fixture

A Crankshaft Set-Up

Interesting milling set-ups are not confined to the connecting rod department. For example, Fig. 5 shows the arrangement used to mill the $\frac{3}{4}$ in. counterweight slot in the crankshaft front section. Four pieces are held at once in a V-block fixture which locates the work from its ground cylindrical surfaces. Collars with outside diameters equal to the largest diameter of the shafts are slipped over the smaller sections to provide a long parallel surface to rest in the V-block. Locating buttons on the vertical portion of the fixture come in contact with the sides and backs of the flanges although they cannot be seen in the illustration. The work is clamped vertically by means of

two plates provided with soft copper jaws so as not to mar the ground surface of the work, each plate holding two pieces. The horizontal clamps which are tightened from the back have buttons which push against the flanges opposite the buttons in the fixture. The cut is made in one pass in a No. 2 Cincinnati mill. This operation merely trims off a central webs the outer edges of the slot having been roughed out previously.

An indexing fixture is used on the crankcase front end for the 16:11 geared motor. The operation, shown in Fig. 6, is that of milling the valve tappet guide pads which are eighteen in number. At the left may be seen the block used for setting the cutter to the proper depth. The work, which is an aluminum alloy casting, is located by a shoulder on the back face near its largest diameter and by the oil drain hole in the same surface. The cut is taken by an end mill in the spindle of a Lucas horizontal boring drilling and milling machine. A latch releases the rotary section of the fixture for indexing.

How the Small Shop Can Help Recovery

JOHN R. GODFREY

SMALL shops can play a real part in general recovery whether they come under a specific code or not. And the best way in which they can help the country, as well as themselves, is to refrain from taking any job below cost. Cost in this case must be figured on a fair wage rate and hours that conform to the spirit of the times. A fair return should also be figured for the time of the boss himself, although that is perhaps less important than that other costs should be right. If the boss wants to pass up a vacation, or a new suit, it affects only one sale.

One great difficulty is that comparatively few shops figure costs in the same way—and some seem to guess at cost instead of figuring at all. Figuring rent, wages and material is easy. But if the boss happens to own his own shop he is likely to forget to charge rent against the property. If he makes his prices on that basis he is not only cheating himself, but he is unfair to the shop that has to send a rent check every month.

Theoretically each machine should carry a different rate of overhead, depending on its cost, power consumed, space occupied and its rate of obsolescence. Practically, this would cost more for bookkeeping than it would save. And office help has to be kept at a minimum in the small shop. One old shop I knew of had two plug hats that had seen better days. Bills to be paid went into one hat. When they were paid and receipted they went in the other hat. The difference between the bills in the first hat and the bank balance was the worth of the business. Bills receivable didn't count, nothing but money in the bank. Simple, but not to be recommended. Still it is a good thing to bear in mind when someone proposes a lot of paper work for the small shop.

Most shops, even good sized ones, fix a general machine-hour overhead rate that covers the whole shop. This is done on the assumption that the average job will utilize a variety of equipment, from the largest machine tools to the inexpensive bench vise. One good contract shop of more than average size uses a rate of 72 cents an hour as machine overhead. If, however, a job requires the use of the large and expensive equipment on a large percentage of the operations, the shop overhead is increased against this particular job. Likewise, a contract that is very largely a bench job, carries a lower overhead. The charge for labor naturally varies with the skill required and the rate paid.

One small shop I know has a rather simple and unique method of charging for time spent on a job. It is not recommended for general use but has carried this shop through some very lean years. In slack times the boss does all the work himself. If the job would ordinarily be done by a helper, he collects helper's wages for himself. If it is a toolmaker's job the customer pays at the usual rate for this kind of work. His charge for shop overhead is 25 cents an hour per man employed on the job. This is of course altogether too low for most shops but he has small expenses and has made it work in this case.

Unconsciously, perhaps, this shop has adopted the principle advocated years ago by H. L. Gantt, one of the most practical of the old efficiency experts group. Gantt pointed out that it was unfair to penalize a customer with the increased overhead caused by the shop running at low capacity. The method of the small shop just mentioned complies with this principle, even though the rate per hour for general shop overhead is too low for most shops.

Small shops in general have a lot to do in educating their customers as to rates to be charged for work. In too many sections of the country the rate hovers between $1 and $1.50 an hour regardless of the kind of men employed or the cost of the equipment used. In many cases this charge does not cover all costs and a fair profit. Yet, so shop men tell me, an attempt to raise the rate drives customers to another shop. The rate per hour seems to mean more than the total cost. In some cases it is necessary to stretch the hours put in on a job to get a living price out of the job. Just as some men are cheaper to hire at a dollar an hour than others at fifty cents, so are customers frequently better off to forget the rate per hour and consider only the total cost and satisfaction of having a good job.

Manufacturing plants frequently send to job shops work too big to be handled in their own repair shops. Speed and accuracy in making the repair is often worth many times the time taken at the hourly rate. Work of this kind should be paid for at a rate in keeping with the service rendered, and paid cheerfully. Satisfactory service deserves its reward. Fair play to men, to customers and to other shops will aid in helping national recovery.

Securing Hub Liners to Locomotive Driving Wheels Discussion

M. P. DALTON
Sevenoaks, Kent, England

In an article under the title given above (*AM*—Vol. 77, page 827), David Williams describes two methods of securing hub liners to driving wheels.

On similar heavy work I have had good results in using driven pins instead of studs or rivets. The inner ends of the pins were pointed to an included angle of 120 deg. and the bottoms of the holes were made flat with a square-ended drill. Pins having this angle are easily deformable, and when they are driven against the bottoms of the holes they swell easily.

"Quarter-Tenth" Tolerances on Rayon Pumps—II

FRED H. COLVIN
Editor, American Machinist

All the operations shown in this concluding installment contain many suggestions that can be utilized for other types of work

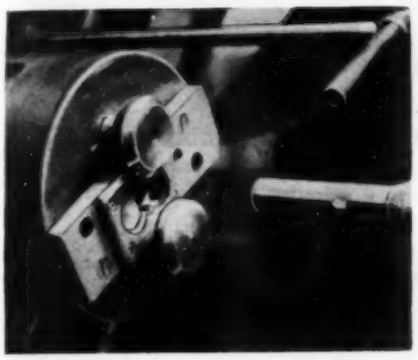


Fig. 10—Center plates were formerly bored in this special chuck, the plate being shifted for the boring of the two centers

THE CENTER plates of the rayon pumps built by W. H. Nichols are made from flat stock drawn with beveled edges. These are approximately ¼ in. thick on the standard pump and are beveled on the end when they are cut off and punched to shape, but with sufficient stock left for broaching and grinding. These plates were formerly drilled for the holding screws, located on pins in these holes, and bored as in Fig. 10. The spacing of the holes was secured by reversing the center plate on the pins. Broaching, however, has eliminated this operation, four plates being broached at one pull in the Lapointe machine, Fig. 11.

This broach was developed especially for this work, and is made up of three sections, both outer sections which broach the pockets for the gears being fastened to the central bar. One feature that helped along the success of this broach was the cutting of the pulling keyway through the three sections of the broach. This relieved the stress on the screws holding the broach together by making each section pull its own cut.

Using the broached holes as locating points the holes are drilled and reamed in an indexing jig, Fig. 12. The end holes fit over the two pins while in the front position. When the jig is swung 90 deg. to the left, the locating pins act as guides in the bushing plate above and insure correct location of the center plate. The holes are only spotted under

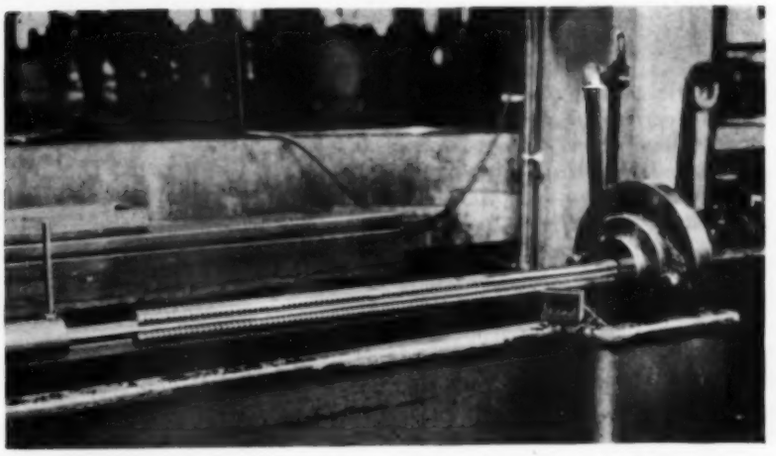


Fig. 11—Four plates are now machined at each pull of the broach. The broach is made up of three parts and the pull key acts in a slot that goes through all three parts

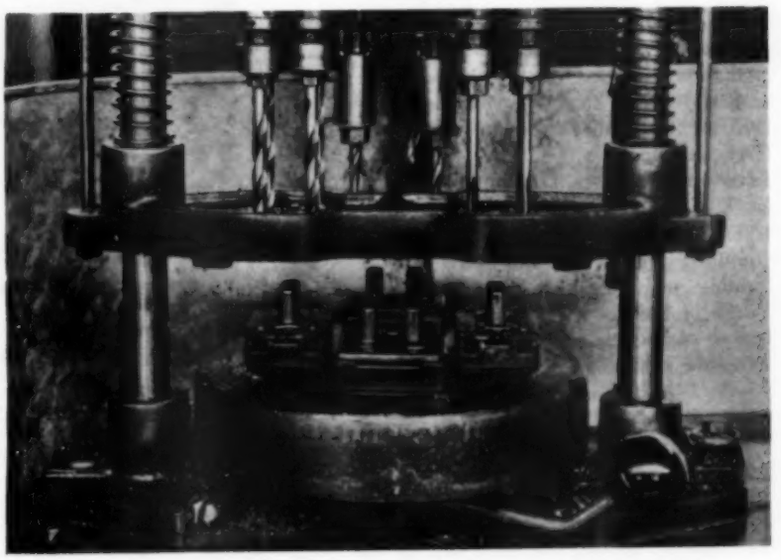


Fig. 12—Drilling and reaming center plates. The first drills spot the holes which are then drilled by the rear group without guide bushings. Note guide pins under bushing plate

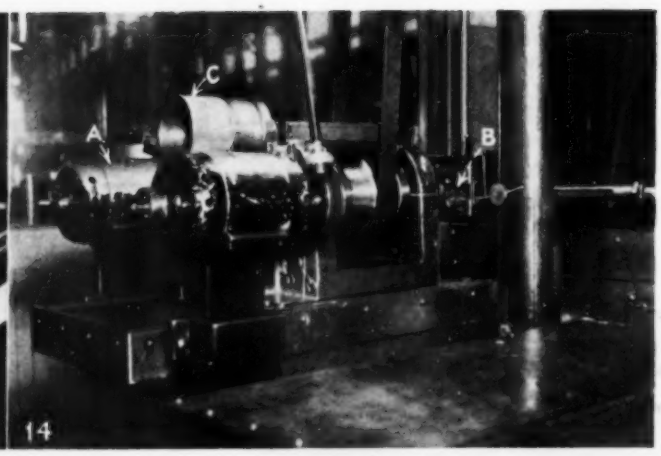


Fig. 13—Sixty center plates are ground at one setting on a large magnetic chuck. Fig. 14—Grinding the gear pockets on a special machine with two planetary grinding heads

the bushing and are then swung under the four drills at the rear which drill the holes through. The last position reams the four holes, the locating pins acting as guides here as well as at the first station, so that there are always four guide pins in the bushing plate, insuring correct alignment. After the jig is full a drilled and reamed plate is taken off at each operation. This is a particularly interesting type of jig and one that can be adapted to many uses.

These center plates are then ground in batches on a Norton machine as in Fig. 13, the magnetic chuck holding 60 at each loading. The lapping operation is done in lots of 32, there being four openings in each of the eight carrier or workholding plates. The action of these lapping holders produces a very uniform thickness and flatness. But to insure uniformity the machine is stopped, the pieces taken out, washed and replaced in other work holders. An optical test gage is set by a standard test block and then each plate is measured at several points. I hesitate to name the tolerance to which these plates and the gears that run in them are held, as it sounds incredible. But with large magnification the lapping operators have no difficulty in holding the work to "quarter-tenth" tolerance.

Those familiar with the making of standard gage blocks will recognize the lapping procedure used in the final finishing of these center plates. Both the center plates and the gears are held to as close tolerances as are many shop gages. Both plates and gears can be wrung together like gage blocks.

Next comes the grinding of the gear pockets in these center plates on the machines shown in Fig. 14. The planetary grinding spindle is driven by the two motors shown, one each side of the spindle, which equalize the drive on the spindle instead of pulling it to one side. These motors are mounted on the upper end of pivoted arms which are under light spring tension. This method of mounting permits the motors to swing on their mounts and keep an even tension on the driving belts as the spindle travels in its path around the periphery of the hole being ground. These spindles run at 50,000 r.p.m. and have given very satisfactory service. The motors are shown at *A* and the work at *B*.

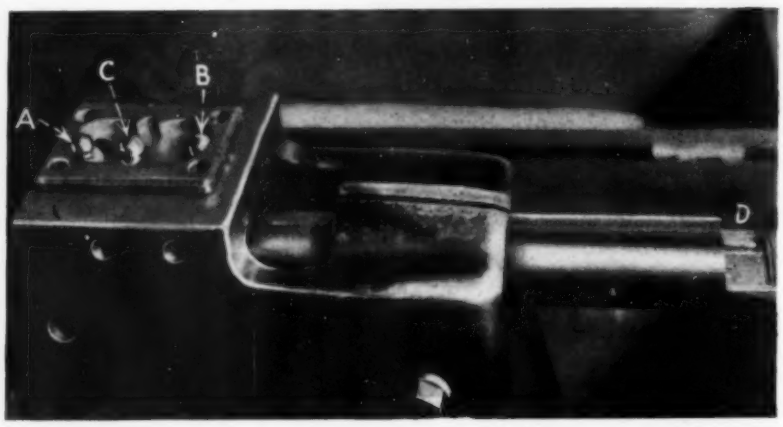


Fig. 15—Checking both the extreme dimension of the opening and the diameter of each gear pocket with three ball contacts. Variations are magnified by a long needle

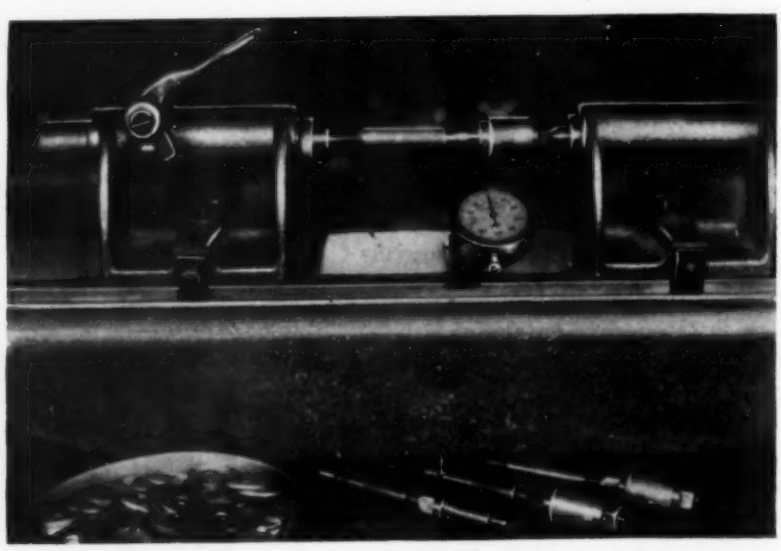


Fig. 16—Accuracy of the gears begins with the careful centering of the blanks on their mandrel. Gears and loaded mandrels are seen in foreground

The large micrometer sleeve at *C* controls the eccentricity of the grinding spindle and so determines the diameter of the ground hole. The size of the micrometer sleeve makes it very easy to move the wheels so as to grind less than tenths. The plates are located from the four reamed holes, and are then clamped in position, the subsequent operation of the machine being automatic, including the indexing from one hole to the other.

Both the diameter and spacing of these holes are checked by the gage in Fig. 15. In the position shown the outer balls *A* and *B* check the distance of the outer surfaces of the bores from each other. The hole diameters can be checked by using the two balls at the left *A* and *C*, in each gear chamber, the indicator *D* at the right showing tenths.

The gears which do the actual pumping are made from blanks cut from bar stock in a screw machine. They are bored, chamfered in each end of the bore and cut off with only a grinding allowance on the sides. The gears are approximately 1 in. in diameter and have 28-32 d.p. stub teeth. The teeth are cut on high speed Fellows gear shapers in gangs of six, but before cutting, each gang of gears is carefully centered on the mandrel in the little bench indicator, Fig. 16.

The gears are kept on the same mandrel until after burnishing, which is done in the Fellows burnisher, Fig. 17. The gears are carefully washed in a grease solvent and then blown clean by a special hooded air jet beside the machine, before the gears are burnished.

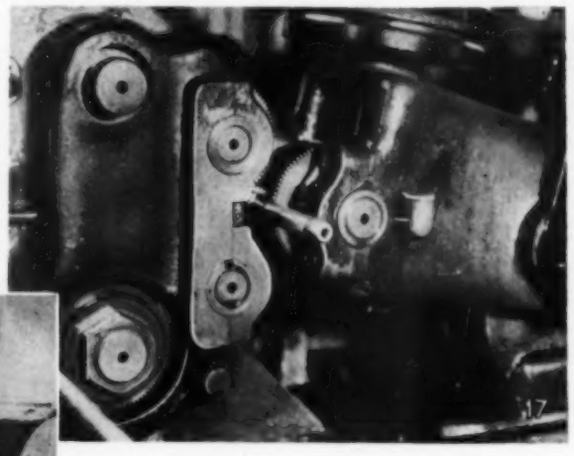


Fig. 17 — After the gears are cut on the same mandrel the teeth are burnished between the hardened master gears shown

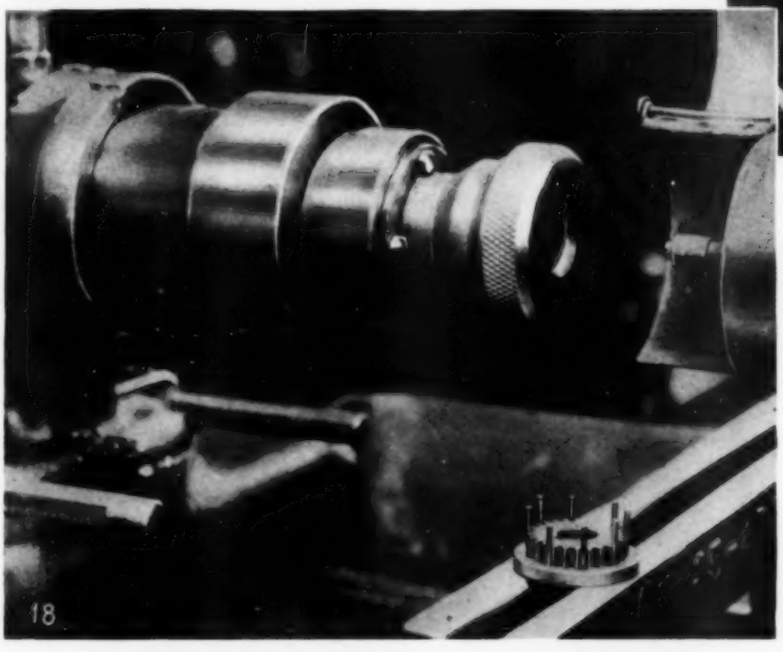


Fig. 18—This pin gear holder fits in a chuck and centers the gear for grinding the hole true with the pitch line

After the teeth are cut and burnished the holes are ground concentric with the teeth, using the pin holders shown in Fig. 18. These pins fit the pitch line of the gear teeth, while the holder and gear is pushed into a sleeve that just fits the outside of the pins. This method of holding insures both centering the gear and holding it square against the face.

The outer diameter of the gears is ground to the finish diameter as the clearance in the center plate is but 0.0002 in. The gears are then lapped on machines similar to those already shown, the circular carrier or work holders being seen in Fig. 19. This is much the same method used in making round gage blocks.

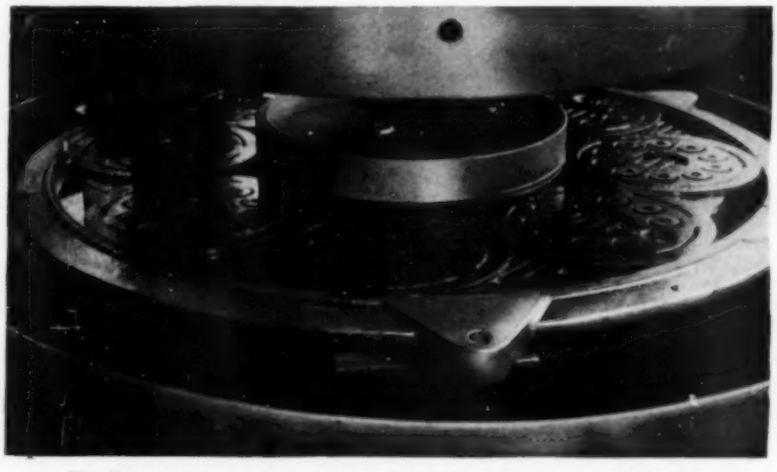


Fig 19—Gears are lapped on both sides in the special holders shown. The work holders both rotate and travel around with the lap in a sun-and-planet path

Gears are carefully checked on the special gages seen in Fig. 20. It is essential that the gears be square on their shafts and this is checked in another special device.

Pitch diameters of the gears are tested in the vertical gage by opposite contact points. They are checked at several points. Concentricity of gears on the shafts is checked by gage in foreground. The shaft rests in V-blocks at each side of the gear while the pointer on the dial indicator shows variations, if any, at various points. The close uniformity in the amount of viscose pumped per revolution makes concentricity of great importance.

The inspection room contains more

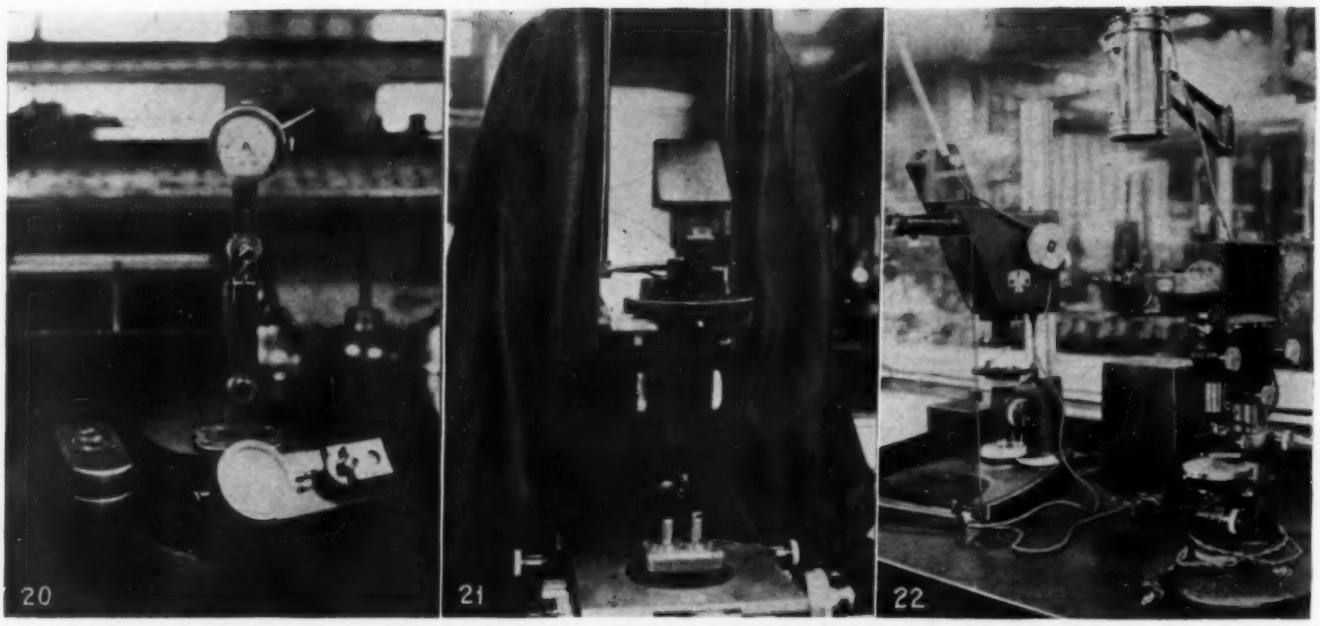


Fig. 20—Gages for checking accuracy of gears. One tests the concentricity and the other the pitch diameter. Fig. 21—This magnifies tooth contours and shows errors in form. Fig. 22—Another precision instrument that helps to keep work and gage accurate

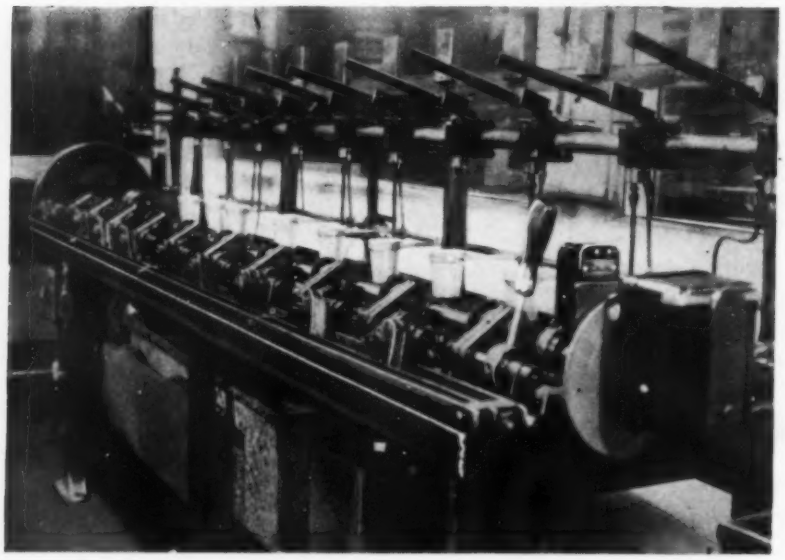


Fig. 23—Test rack for complete pumps. Each pump delivers into one of the cups shown. The amount pumped by each is held to a very close tolerance

high grade testing devices than are often found, especially in a shop of anywhere near the size. One of these instruments is seen in Fig. 21. This is used in checking gear tooth contours by greatly enlarged projection as can be seen by the form drawn on the chart in the machine. This instrument can also be used to show the rolling action of the teeth of a pair of gears and so detect any inaccuracy that might creep in.

Beside it, Fig. 22, are two of the latest Zeiss instruments of various uses. The newest one, at the left, has glass shields to protect it from the heat of the operator's body. A good supply of instruments of this kind, and the knowledge and will to use them, has helped to make the accuracy attained in this shop possible. The other instrument provides a highly refined method of checking the thickness of gage blocks or pump parts, as occasion demands.

These pumps are assembled without the selection of any parts. It is the only strictly interchangeable manufacture and assembly within such close limits, that I recall. Automobile builders, regardless of class, select pistons and piston pins, but here nothing is selected. For not only must the parts go together but the pumps must deliver a uniform amount of viscose to the orifices that form the threads. Running at only 20 to 30 r.p.m. they pump against varying pressures, and are guaranteed not to vary the volume delivered more than one per cent.

After assembly the pumps go to the test room and are mounted on the test racks, one of which is shown in Fig. 23. They are mounted and driven just as in actual service in the rayon mills. The tank or pan contains oil of a viscosity resembling viscose and the room is kept at a constant temperature.

The Names of Things

Just what we call a thing isn't particularly important if the name we use means the same to the rest of the party as it does to us. It's when a "duhicky" means one thing in your shop and another somewhere else that the trouble comes. To prevent loss of time, temper and money the A.S.M.E. committees on standardization are now making a standard nomenclature of the subject a part of their reports. This nomenclature is proposed by each committee and passed on by another committee to insure uniformity in terms used in different fields.

There are few engineers or production men who cannot recall expensive and exasperating delays caused by the use of different terms for the same thing, or the lack of designated names for commonly used articles in various parts of the country. While logical names are to be desired wherever possible, any name that means the same in Maine as in California is better than our present lack of uniformity.

EDITORIALS

VOLUME 78 AMERICAN MACHINIST ESTABLISHED 1877 McGRAW-HILL PUBLISHING COMPANY, INC. NUMBER 7

K. H. CONDIT F. H. COLVIN

EDITORS

WIDENING THE BREACH

APPARENTLY there is much to be said for the Wagner Bill to put teeth in the troublesome Section 7(a) of NIRA—at any rate much *has* been said at the committee hearings. Let us admit at once that this Section has done little beyond what we said it would do when NIRA was first introduced, and that is to stir up discontent. And let us admit also that there has been fault on both sides. Labor leaders have, some of them, had rosy visions of a gorgeous racket; and employers have, some of them, made little attempt to live up to the spirit of the law.

Admitting all this we cannot but agree that some qualification and interpretation of the loosely drawn Section 7(a) is necessary, but does Senator Wagner's bill meet these requirements? Every effort is made in this bill to protect the employee from unscrupulous employers, none whatever to protect him from the racketeering type of labor leader. Every restriction and responsibility is placed on industry, none whatever on labor, which is hardly in accord with the expressed intent of the bill to foster cooperation between the two.

AS A MATTER of fact it is hard to see how a bill could have been drawn that would do more to drive the employer and his men apart. Unless the terms of this bill are drastically changed it will probably be quite as difficult to enforce as the Volstead Act, and will be productive of far more strife and discord. In view of the real advances toward harmony that had come about prior to 1933 through the efforts of thoughtful men on both sides of the fence, it is deplorable to see proposed a law that will reopen old wounds and throw industrial relations back a dozen years.

Shall we never learn that reforms seldom come through legislation?

Intermediate Credit

AT LAST we are getting down to the nub of the matter. Since long before the present administration took office those who were in a position to know have insisted that no full measure of prosperity could be attained until the capital goods industries were busy again. Now we have President Roosevelt throwing his powerful support to the proposal to establish Intermediate Credit Banks in the Federal Reserve Districts for the purpose of providing smaller companies with loans of working capital. In this category come expenditures for maintenance and modernization of equipment. The term of the loans is anything up to five years.

Banks organized to handle this particular kind of credit are a crying need just now, but there has been a need for them for many years. The variety of credit they offer falls midway between the short-term paper of the commercial banks and the security flotations of the investment market. Intermediate term credit has been available through the commercial credit companies, it is true, but its use has been confined almost entirely to the financing of durable consumer goods, and its cost has been too high to make it attractive to industry.

On the heels of the intermediate credit bank proposal comes one for providing corresponding credit through the Reconstruction Finance Corporation. Mr. Jones says that this credit will be supplemental to that offered by the Intermediate Credit Banks, but some of us may perhaps be permitted a grin or two at the spectacle of two Washington groups fighting to see which shall have the privilege of extending loans that were taboo only a year ago.

. CHIPS .

Washington—Labor troubles divert Administration attention from other worries . . . Labor supports Wagner Bill, industry opposes it . . . Automobile controversy over union recognition is taken to Washington . . . Dissatisfaction with NRA becoming more vocal . . . Senate votes down St. Lawrence waterway treaty . . . Lindbergh, Chamberlin, Rickenbacker and others testify against proposed air mail legislation . . . Mail flying resumed by Army on restricted basis . . . Air express doubles as letters are sent in bulk to be mailed at destination . . . Roosevelt for unemployment insurance . . . Federal Trade Commission points out faults in steel code saying it creates a monopoly.

Foreign—New Japanese war vessel turns turtle during tests . . . Most of crew lost . . . British Commons passes bill to build navy up to treaty strength . . . Soviet trade mission coming soon to discuss export and import problems . . . Commissar for heavy industry says that little machinery will be imported because production in Russian machinery building plants is increasing rapidly . . . Hitlerites act to force Jews out of Army and Navy . . . Great Britain wondering what to do with forty million pound revenue surplus . . . Mussolini signs important political and economic agreements with premiers of Austria and Hungary . . . German business is unified under 12 dictators headed by Kurt Schmitt, Minister of Economics . . . Sweden extends long-term loan to Soviets . . . Arming of factions threatens civil war in France.

Finance—Stock market marks time to see how much further strikes are going to interfere with business . . . Stock exchange control and securities bills likely to be revised as result of testimony at hearings . . . Supreme Court permits Pennsylvania Company to hold Wabash and Lehigh Valley stock . . . Repayments on RFC loans are averaging $3,000,000 daily . . . Income tax payments running ahead of last year.

Industry—Strikers return to Aluminum Company's plants . . . Carboloy February sales up 241 per cent over last February . . . Railroad wage problem reaches deadlock and President Roosevelt calls in Commissioner Eastman to act as arbitrator . . . Ford restores $5-a-day minimum . . . Packaging machinery and refractories industries announce hour reduction and rate increase . . . U. S. Steel employees vote revisions of representation plan that make it more liberal . . . Delaware & Hudson officials come to agreement with brotherhoods on pay differences . . . Roosevelt executive order closes bids to companies that fail to comply with NRA requirements . . . NRA election at Budd plant draws so few votes that previous vote for employee representation plan stands . . . ICC approves Lackawanna PWA loan of over $4,000,000 for 25 new locomotives, 500 steel hopper cars and rebuilding of other equipment.

Trade—Two big New York department stores cease buying German goods, one closes Berlin office, because of lack of demand . . . Woolworth stores follow suit . . . National Retail Dry Goods Association opens fight on "unjustified" price increases in manufacturing codes . . . Electrolux reports refrigerator sales so far this year 300 per cent ahead of 1933.

Indicators—Steel production holds at just under 49 despite strike threats . . . Electric power output at 95.2, 20 per cent ahead of corresponding week last year . . . *Business Week's* index drops four-tenths to 64.4.

New Recovery Drive Based on Capital Goods Revival

From now on recovery is to be based on the capital goods industries, whose 6,000,000 unemployed have remained untouched, until now, by government plans. The keynote will be "Rebuild America," beginning with deferred maintenance, in industries and buildings, residential rebuilding, modernization, construction, etc. This is a major administration policy, adopted at the March 13 meeting of the National Emergency Council, with President Roosevelt in the chair.

The action was taken after an appraisal of the spirit of the big Code Authority Conference in which official government spokesmen bore out the analysis that the keystone of the arch of recovery was overwhelmingly held, by the assembled industrialists, to be the capital goods revival. It took into consideration the showing of statisticians that the consumer goods industries had reached, in January, the peak of the production that could be hoped for, or was desirable, until the capital goods industries and their employees could be brought back into the buying groups.

The decision taken has already been put into effect. The President has launched his message in support of direct government loans to industry. The NEC has had made a survey of construction needs of every sort, and of the means available and required to meet them. The Construction Industries Advisory Committee, set up by the code authorities after the convention to advise with General Johnson has launched a study to determine what capital replacements are needed in their factories and to find out why they have not been made (lack of capital, fear of NRA, fear of the monetary situation or what). The Capital Goods Industries Advisory Committee, set up at the same time, has sent out a searching questionnaire that will form the basis of a report to take the guessing out of what it can do and what the results will be for the recovery program. The two new special assistants to the Administrator of NRA, W. Averell Harriman and Nelson Slater, and the staff of the Division of Research and Planning under Leon Henderson are working at full tilt on a parallel report on the whole picture. These three NRA studies will probably be issued in the form of a report to the American people on this new phase of NRA. The Capital Goods Advisory Committee questionnaire calls for replies by April 2. The whole series will be finished shortly thereafter.

Meanwhile, increasing evidence of this new phase of NRA may be expected. Already a spirit closely approximating that of last summer is becoming evident at NRA headquarters. There is something to work for, to get the Johnsonian teeth into, something better than a dying CWA and a drive to get shorter hours and higher wages for remaining employees out of industries that mostly cannot meet the demand, as a solution of the recovery problem. The argument of the wisest advisers of NRA (now mostly all departed) has long been that no recovery can be sound that is out of balance, and that without the capital goods revival, NRA was bound to continue to be out of balance. Chiefly, the change in front indicates a passing of the fear that modernization would make "fewer jobs" and in its place the rising of the faith that modernization of plant would make more and cheaper goods, increase consumption and put millions of men to work making the machines and the goods for the others, and for themselves, to buy.

While the financing of the capital goods recovery program will come in the first place through government agencies, and thus cannot be looked to to show any great speed immediately, it is expected that private capital will follow, tempted by prospective returns, by the faith engendered through the administration's turn to these recognized principles of recovery, and by the revision of the Stock Exchange Bill and of the Securities Act (which is soon to come), both of which are part of the broad plan of capital goods revival. The only point made (as in all the recovery program plans) is against expectation of too early results in general employment, the hope being for a marked Autumn upturn, and for an easier Winter to follow. The psychological effect is, however, always carefully discounted, so far with considerable reason in the recovery plans. But that this new policy marks a turning point in the whole recovery program is felt by many thinking leaders in the administration, who call it a complete change of front, away from planning meticulously to spread a limited national income throughout the social body into plans for increasing that national income through balanced revival of all industry, so that all may share.

W. A. Harriman Made Special Administrator

Succeeding L. D. Tompkins, resigned, W. A. Harriman has been appointed special assistant national recovery administrator. Mr. Harriman will be succeeded as division administrator in charge of Division II by Alfred R. Glancy, former president of the Oakland Motor Car Co. and vice-president of General Motors from 1926 to 1930.

Earle W. Dahlberg, for more than 20 years associated with the Victor Talking Machine Co., has been appointed to be deputy administrator assigned to Division III. Mr. Dahlberg joined the National Recovery Administration as assistant personnel officer.

Neil Foster Suggests Apprentice Plan

One plan for increasing employment in the capital goods industries, suggested by Neil W. Foster, assistant deputy in that division, is to put on apprentices at minimum wages in numbers up to ten per cent of the employment in each industry for a guaranteed period of six months. This would meet the demand for skilled workers against the time when business picks up and put something over 200,000 young men to work. The shortage of skilled men was emphasized in the recent code authorities conference.

Shorter Hours Find Limited Acceptance

First to accede to the President's proposal for still shorter hours and higher wages, the refractories industry recently announced a ten per cent cut in hours and a ten per cent increase in wage rates. This was followed promptly by a still more drastic change by the packaging machinery industry which cut the work week from 40 to 30 hours and raised the pay from 40 to 50 cents an hour.

One thousand men were added to the payroll of the Schenley Products Co. by a ten per cent reduction in working hours and a corresponding increase in rates. This company acted independently of the distilling industry.

Under pressure of a strike threat, the automobile industry made a similar revision of hours and wages. This move was made to win support of employees, public and the administration against the "artificial issues" raised by American Federation of Labor organizers.

However, the manufacturing industries in general have been rather reluc-

tant to curtail hours further. One deterrent is a shortage of skilled men at present, or in prospect with the shorter week. Another is the lack of flexibility that will result if manufacturers bind themselves to rigid restrictions which may prove highly embarrassing with a further increase in business activity.

Industries whose codes are now being heard are being urged by the deputy administrators presiding to cut hours ten per cent and raise wages ten per cent.

Durable Goods Committee Gets New Members

In addition to the original members (*AM*—Vol. 78, page 220e) of the Durable Goods Committee, appointed to consult with Recovery Administrator Hugh S. Johnson, the following have been named: Robert W. Irwin, Robert W. Irwin Co., furniture manufacturing, and Harry S. Kimball, chairman, code authority, fabricated metal products industry.

Administration Makes Code Authority Appointments

Continuing his appointments to code authorities, National Recovery Administrator Hugh S. Johnson recently named a number of men for industries in which the government had previously no representation and a number of others to relieve members of his own staff who had temporarily taken over these additional duties.

Of the new appointments were those for the following industries:

Hand chain hoist manufacturing—Col. Charles R. Sanderson, U. S. M. C.;

Foundry supply and steel wool—George M. Forrest, consulting engineer;

Gray iron foundry and metallic wall structure—W. C. Connelly, former president of the American Boiler Manufacturers Association;

Can manufacturing—Jarvis Williams, Jr., president of the Standard Cap and Seal Corporation;

Alloy casting, Major F. H. Miles, Jr., U.S.A.;

Railway brass car and locomotive journal bearings and casting manufacturing—E. G. Vail, formerly president of the Guernsey Refrigerator Co.;

Scientific apparatus—Lyman J. Briggs, Bureau of Standards;

Photographic mount — T. Heberton Dean, machine tool manufacturer;

Washing and ironing machine manufacturing—W. L. Cherry, president of the Cherry Burrell Corporation;

Unit heater and unit ventilator manufacturing; fan and blower; non-ferrous and steel convector manufacturing—Lieut. Col. F. S. Strong Jr., now head of one of the Booth Companies.

Successive administration members were named for the following industries:

Commercial refrigeration—D. C. Duncan, professor of marketing and management, Northwestern University, to succeed William Lawson;

Paper making machine builders—Charles Hommeyer, vice-president of the Union Central Life Insurance Co., to succeed George S. Brady;

Gasoline pump manufacturing—S. B. Bechtel, president of S. F. Bowser Co., to succeed N. S. Talbott.

Malcolm Muir Urges Halt on Business Legislation

In an address before the Illinois Manufacturers Association, on March 20, Malcolm Muir, President of the McGraw-Hill Publishing Co., stated that a "hands off" policy on the part of the government for a reasonable length of time would work wonders toward recovery. He deplored hasty tactics, typified by the air mail action, which tend to blight the release of private capital into industry.

Mr. Muir pointed out that whereas NRA first concentrated on the stimulation of purchases of consumer goods it later placed emphasis on the need of aiding the capital goods industries to wipe out employment. Consequently, he expressed disappointment on reading in the *New York Times Magazine* an article by Donald Richberg, general counsel for NRA, which came out flatly with the statement that the heavy industries should be disregarded. Replying to Mr. Richberg's references to "miles of idle locomotives and cars rusting upon storage tracks," Mr. Muir stated that obsolescence had been overlooked.

Fair and normal profits are essential in any well organized economic system, he pointed out, else there can be no industry and no employment. Only in this way can new capital and credit be attracted to industry and that is our chief problem today.

Mr. Muir advocated amendment of the Securities Act and the provision of credit to industry—small industries especially—by the government itself as soon as practical machinery can be set up. He strongly advocated a moratorium on business legislation to give the original NRA plan of self-regulation an opportunity to work before applying further corrective measures.

New England Council Studies Small Industries

Based on 408 usable returns, a survey of effects of NIRA on the small shop was presented at the quarterly meeting of the New England Council on March 17. Of those firms reporting, 28 per cent felt that their codes had helped them, 28 per cent said their codes had the effect, while 43 per cent believed that their codes had hurt them.

Higher costs with lower profit margins were the chief objections. Despite this, over 68 per cent of the companies showed an increase in income from improvement in sales, and a great majority were optimistic as to the business future.

Employment increased in 54 per cent of the plants but profit margins de-

Metal-Working Code Hearings Scheduled

Date	Place	Deputy Administrator	Association
March 30	Raleigh Hotel	G. S. Brady	Packaging Machinery Manufacturers Institute
April 2	Ambassador Hotel	H. O. King	National Association of Safety Razor & Safety Razor Blade Manufacturers
April 2	Raleigh Hotel	H. O. King	Electric Hoist & Monorail Manufacturers
April 5	Willard Hotel	A. R. Glancy	File Manufacturers
April 5	Willard Hotel	A. R. Glancy	Spring Manufacturers
April 5	Willard Hotel	A. R. Glancy	Brass Forging
April 5	Willard Hotel	G. S. Brady	Anti-Friction Bearing Manufacturers
April 5	Willard Hotel	G. S. Brady	Wire, Rod & Tube Die Manufacturers

creased in over 56.5 per cent, ranging as high as 19 per cent off.

Higher selling prices over the previous year were reported by 62 per cent and lower prices by 6 per cent. An increase in costs was claimed by 83.6 per cent of the plants filing returns with higher payrolls for 69 per cent. Seventy per cent showed shorter working hours.

To offset higher manufacturing costs, 53 per cent of the firms raised their selling price, 24 per cent did nothing, 5 per cent increased sales activity, 5 per cent improved methods, and 3 per cent installed modern machinery. To get more business 22 per cent are using usual selling methods and 14 per cent have increased their advertising expenditures.

Typical statements from representative small plants in the metal group are as follows:

Oil burners—"Increased selling costs of material and labor; no increase and, in most cases, a decrease in the selling prices with a second decrease in the margin of profit. Decreased sales by the standard reputable manufacturers because of the low priced "gyp" competition of sales below cost—all a direct result of the oil burner code."

Mechanics hand tools—"Competition is keener than ever, with the larger manufacturers underbidding for business. Manufacturing costs are increased but, with no increased demand for tools, it is impossible to get better prices. It has been difficult to make any headway."

Screw machine products—"Increased volume has been of great benefit to us, but we have seen little or no opportunity to advance prices, and the continued increase in our costs due to the NRA seems likely to cause us trouble later on."

Machine Tool Index Falls for February

Compared to 101.7 for January, the index of gross orders compiled by the National Machine Tool Builders' Association for February showed a sharp drop to 86.4. Net orders, allowing for cancellations, were at 85.9. However, the three months' moving average, which is used to indicate the trend, was up slightly to 104.8 as against 103.6 last month and 27.5 a year ago.

Shipments for February at 96.5 were better than those for January when the index was 62.9. Unfilled orders were 205.0 contrasted with January's 206.9. Last year's February figures were 26.7 and 35.3 respectively.

Foreign orders formed 25 per cent of the total as compared to 22 per cent for January.

Works Plan Sponsored in Auto Strike Peace

President Roosevelt's statement on Sunday, March 25, gave the conditions of a compromise by which a strike scheduled for Monday was avoided. While the settlement itself was of prime importance, because of the far-reaching repercussions involved in a tie-up of the automobile industry, the principles laid down in the statement are equally noteworthy.

Advocates of vertical unions may find support for their principles in the terms of agreement. The President's remarks included, "It is my hope that this system may develop into a kind of works council in industry. . ."

The five points of agreement under which automobile manufacturers in five cities continue to operate were characterized by the President as "a framework for a new structure of industrial relations." The essence of the settlement was the establishment of an impartial supervisory board of three, recognition of proportional representation of labor groups and the setting up of a principle for laying off surplus labor.

Conformity to Section 7a of NIRA was emphasized in the President's statement. The first point of agreement restates the basis of free collective bargaining and prohibits discrimination because of union labor affiliations. The second part provides pro rata representation on the bargaining committee of each labor group if there be more than one. Point 3 establishes a board of arbitration, consisting of a representative for the employers, a representative for labor and an impartial member, to pass on questions of representation, discharge and discrimination. In the fourth point, the government disclaims its sponsorship of any particular form of representation. Point 5 places the basis of layoffs as human relationships, such as dependents, seniority, individual skill and efficient service in the order named.

• INDUSTRIAL REVIEW •

• During the last fortnight there has been a perceptible slowing down of machinery sales. Dealers and builders attribute the hesitation of buyers in placing orders to apprehension of protracted labor troubles and the consequent threat to the continuation of recovery. The announcement from Washington that the opponents in the automobile labor controversy have been brought together is therefore very welcome. It should result in the stimulation of sales during the next few months.

• Business in the Eastern territory was uneven, some distributors having a better month than February, others not so good. Pittsburgh, at last, has been looking up a bit. Individual orders have been more numerous than at any time in several months. In Cleveland the labor situation is tense. Many of the leading metal-working plants are threatened with strikes. Wages are being stepped up steadily, being approximately at the 1928 level now. Machine tool orders are improving slowly.

• Despite the strike clouds over Detroit the pressure for larger and larger automobile production has kept the supply and equipment business moving steadily ahead. More machine tool orders have been released. Labor trouble in Cincinnati has not been serious so far, most of the metal-working plants are not busy enough. Even though very little new business came in during the last half of March the total for the month compares favorably with those of preceding months. New machinery is moving faster in the Indianapolis district, most of the good buys in used tools having been snapped up.

• There have been strikes in and around St. Louis but business is continuing to improve, nevertheless. One company has decided to move to a better location because of continued labor difficulty. In Chicago business is on a hand-to-mouth basis, deals springing up quickly and being closed or abandoned just as quickly. The labor situation is fairly good. Milwaukee has been struggling with strikes and orders during March were scarce.

Approved Codes in the Metal-Working Industry

(Continued from AM—Vol. 78, page 16e)

Code Sponsor	Maximum Hours	Minimum Wages	Deputy Administrator	Approval Date
C. I. Pressure Pipe Association	36 shop 40 office	35c. North; 30c. South; time and a half for overtime; office workers $15.	King	Dec. 30
Coated Abrasives Association	40	40c.; women and boys on light work, 35c.	Muir	Jan. 2
Household Ice Refrigerator Manufacturers	40	35c.; Kentucky & Tennessee, 31½c. time and a half for overtime; office workers, $15.	Pirnie	Jan. 2
Railway Safety Appliance Industry	40	40c. male; 35c. females on light work, time and a half for overtime.	King	Jan. 12
Wood Block Hat Manufacturers Association	40	40c.; office workers $14-15.	Muir	Jan. 12
National Association of Coin Operated Machine Manufacturers	40	40c. North; 35c. South, office workers $14-15.	King	Jan. 12
Manufacturers of Rwy. Brass Car & Locomotive Bearings and Castings	40	40c. North; 32c. South, office workers $15.	King	Jan. 29
Alloy Castings Association	40	40c.; office workers $15.	King	Jan. 30
Marine Auxiliary Machinery Manufacturers	40	40c.; office workers $15.	Muir	Jan. 30
National Association of Fan Manufacturers	40	40c.; time and a half for overtime; office workers $15.	Murray	Jan. 30
Institute of Cooking and Heating Appliances	40	40c. male; 35c. female North, 27½c. female South; office workers $12-15.	King	Jan. 30
Electrical Industrial Truck Institute	40	40c.; part of FMPF.	Muir	Jan. 31
Chain Institute	40	40c.; part of FMPF.	King	Jan. 31
Slide Fastener Manufacturers Association	40	40c. male; 37½c. female; time and a half for overtime.	King	Feb. 1
Wire, Rod and Tube Die Manufacturers	40	40c.; office workers $16.	Muir	Feb. 2
National Printing Equipment Association	40	40c. male; 30c. female.	Muir	Feb. 3
C. I. & C. I. Radiator	40	40c. North; 30c. South; office workers $14-15.	Muir	Feb. 6
Machine Knife and Allied Steel	40	40c.; office workers $15.	Muir	Feb. 7
Foundry Equipment Manufacturers	40	40c.; time and a half for overtime, office workers $15.	Muir	Feb. 7
Concealed Heater Manufacturers Association	40	40c.; office workers $15.	Murray	Feb. 10
Industrial Unit Heater Association	40	40c.; office workers $15.	Murray	Feb. 10
Saw Manufacturers	40	40c. males; 35c. females; office workers $15.	Muir	Feb. 10
National Band Instrument Manufacturers	40	40c.; apprentices 32c. other employees 35c.	Paddock	Feb. 10
Gray Iron Founders Society	40	25c. in far South, 30c. in near South, 35c. in border states; 37-40c. in North.	King	Feb. 10
American Railway Car Institute	40	40c. North; 35-37c. in border states; 32c. South; 87½% for women.	King	Feb. 17
Manufacturers of Chilled Car Wheels	40	32c. in nine Southern states; 40c. elsewhere; office workers $15.	King	Feb. 17
Allied Manufacturers of the Beauty and Barber Shop Industry	40	40c.; boys and girls not less than 80% of minimum.	King	Feb. 17
Vacuum Cleaner Manufacturers Association	40	40c.; office workers $15.	King	Mar. 3
Newspaper Printing Press Builders	40	40c.; time and a half for overtime.	Muir	Mar. 6
National Hide and Leather Working Machinery Association	40	40c.; office workers $15.	Brady	Mar. 6
Master Engravers Guild	40	40c.	Brady	Mar. 18
American Die Casting Institute	40	40c.; 32½c. on light repetitive work; office workers $14-15.	King	Mar. 18
National Beverage Dispensing Equipment Association	40	40c.; office workers, $14-15.	Muir	Mar. 17
Motorcycle Manufacturers	40	40c.; office workers $15.	Janssen	Mar. 19
Clay Machinery Manufacturers	40	40c.; office workers $15.	Brady	Mar. 19
Metal Lath Manufacturers	40 Mar. 1-Oct. 1 32 Nov. 1-Mar. 1	40c.; office workers $14-15.	Pirnie	Mar. 19
Collapsible Tube Manufacturers	40	40c. males; 35c. females.	King	Mar. 19
Machinery and Allied Products Institute	40	40c.-32c. dependent on locality; office workers $15.	King	Mar. 19

Foundry Equipment Orders Rise Sharply

As reported by the Foundry Equipment Manufacturers Association, the February index of gross orders rose to 65.8 as compared to 37.2 for January and 16.1 for February of last year. Shipments rose from 33.4 in January to 42.9 in February while unfilled orders increased from 33.8 to 56.3. The three months' average of gross orders reached 48.9 contrasted with 39.2 the preceding month and 34.4 in January 1933.

Harnischfeger Gets Big Crane Award

Totaling approximately a quarter of a million dollars, the largest electric crane award during the past five years has been awarded to the Harnischfeger Corporation by the U. S. Reclamation Engineer's Office in Denver. The four 300-ton and one 50-ton cranes covered by this order will be used at Boulder Dam. A 150-ton cableway, spanning the Colorado Canyon, will lower these units to the floor of the power house 600 ft. below the brink.

Saranac to Be Scene of SAE Summer Meeting

June 17-22 is the week chosen for the annual summer meeting of the Society of Automotive Engineers. This year the discussions will be held at Saranac Inn, Lake Saranac, N. Y. Because of the increased activity and many new developments in the automotive field a large attendance is anticipated.

SAE Makes Appointments

According to a recent announcement by John A. C. Warner, secretary and general manager, Society of Automotive Engineers, Edward F. Lowe has been appointed assistant general manager and C. B. Whittelsey, Jr., assistant secretary of the Society. Mr. Lowe came in touch with the automotive industry by way of the paint and varnish business, being at one time manager of the Toronto plant of Brandram-Henderson Co., makers of automobile finishing materials. He was one of the organizers of the Monarch Governor Co. in 1914 and later became general manager of K. P. Products Co. When this firm was merged with the Handy Governor Corp., Mr. Lowe became vice-president in charge of sales. He has been very active in society work and was chairman of the Metropolitan Section in 1928. In 1929 he was chairman of the general membership committee, and in 1932 a member of the transportation and maintenance activity committee.

Mr. Whittelsey has been assistant to the general manager since 1926. Prior to this he was engaged in research work with the U. S. Rubber Co., Curtiss Engineering Corp. and Stone & Webster.

A. D. Whiteside Leaves NRA Post

Third of the four original division administrators of NRA to retire, A. D. Whiteside left on a "leave of absence" recently. Of the nine months he spent at Washington only eight days were devoted to his own job as president of Dun and Bradstreet. He has been one of the rocks of strength in NRA, handling special investigations in addition to his administrative work. He has fought steadily for a realistic attitude and has defended sane price policies and industry relationships. His retirement will result in a general realignment of organization at NRA.

CORPORATION • REPORTS •

Allied Products Corp.
For 1933, net loss $36,165; for 1932 net loss $174,006.

American Radiator & Standard Sanitary Corp.
For 1933, net loss $881,000; for 1932, net loss $5,990,986.

Bearings Co. of America
For 1933, net loss $64,537; for 1932, net loss $122,252.

E. W. Bliss Co.
For 1933, net loss $536,819; for 1932, net loss $1,941,862.

Canadian General Electric Co., Ltd.
For 1933, net income $635,176; for 1932, net income $1,165,661.

Caterpillar Tractor Co.
Two months ended Feb. 28, net profit $500,828; same period in 1932, net loss $312,457.

Chicago Pneumatic Tool Co.
For 1933, net profit $93,090; for 1932, net loss $836,544.

Clark Equipment Co.
For 1933, net loss $108,126; for 1932, net loss $801,462.

Colt's Patent Fire Arms Mfg. Co.
For 1933, net profit $675,132; for 1932, net profit $20,795.

Fairbanks, Morse & Co.
For 1933, net loss $1,147,339; for 1932, net loss $2,547,231.

Foster-Wheeler Corp.
For 1933, net loss $746,820; for 1932, net loss $1,113,599.

Gardner-Denver Co.
For 1933, net profit $95,777; for 1932, net loss $353,340.

General Machinery Corp.
For 1933, net loss $296,456; for 1932, net loss $100,355.

General Parts Corp.
For 1933, net loss $87,085; for 1932, net loss $248,805.

Hamilton Watch Co.
For 1933, net loss $148,560; for 1932, net loss $987,643.

Hayes Body Corp.
For 1933, net loss $288,382; for 1932, net loss $294,076.

Hercules Motors Corp.
For 1933, net profit $76,515; for 1932, net loss $129,814; fourth quarter, net profit $108,775.

Hoover Steel Ball Co.
For 1933, net loss $30,500; for 1932, net loss $224,279.

Howe Scale Co.
For 1933, net income $3,289; for 1932, net loss $287,136.

Hupp Motor Car Corp.
For 1933, net loss $1,778,588; for 1932, net loss $4,515,482.

Independent Pneumatic Tool Co.
For 1933, net income $190,459; for 1932, net income $2,737.

Kellogg Switchboard & Supply Co.
For 1933, net loss $315,711; for 1932, net loss $749,818.

Manning, Bowman & Co.
For 1933, net loss $24,271; for 1932, net loss $125,242.

Marchant Calculating Machine Co.
For 1933, net loss $357,270; for 1932, net loss $215,865.

National Enameling & Stamping Co.
For 1933, net profit $274,097; for 1932, net loss $439,321.

National Rubber Machinery Co.
For 1933, net loss $57,763; for 1932, net loss $210,949.

New Britain Machine Co. and New Britain-Gridley Machine Co.
For 1933, consolidated net loss $179,599; for 1932, net loss $234,032.

Package Machinery Co.
For 1933, net loss $27,313; for 1932, net loss $61,429.

Ruud Mfg. Co.
For 1933, net loss $61,156; for 1932, net loss $200,084.

Saco-Lowell Shops
For 1933, net income $227,807; for 1932, net loss $761,002.

Square D Co.
For 1933, net income $93,028; for 1932, net loss $124,487.

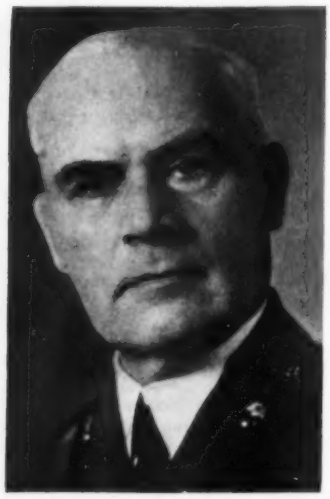
Westinghouse Air Brake Co.
For 1933, net loss $659,560; for 1932, net profit $1,421,247.

Westinghouse Electric & Mfg. Co.
For 1933, net loss $8,636,841; for 1932, net loss $8,903,540.

Universal Products Co., Inc.
Year ended Oct. 28, net loss $1,016,893; previous fiscal year, net loss $1,250,283.

• PERSONALS •

BRIG. GEN. W. H. TSCHAPPAT, assistant to the chief of ordnance, has been appointed by President Roosevelt as chief of ordnance, effective June 2. If confirmed by the Senate, the promotion carries the rank of major general. Gen.



Tschappat will succeed MAJ. GEN. SAMUEL HOF who is retiring. Gen. Tschappat was graduated from the United States Military Academy in 1896 and was made brigadier general, assistant to chief of ordnance, in 1930.

A. R. FORS, in charge of the tool and planning division at the Continental Motors Corp., and general works manager since last fall, has accepted a position with the manufacturing division of the Chrysler Corp., it is understood.

DR. FRANK R. HENRY, for many years secretary of the Grinding Wheel Manufacturers Association, was elected president at a recent meeting. H. B. LINDSAY has been appointed executive secretary with headquarters at Worcester, Mass. Mr. Lindsay was recently deputy

DR. FRANK R. HENRY

administrator of NRA, and has spent a large part of his business life in the grinding machine and wheel business.

GEORGE D. SHANAHAN, president and general manager of the Motors Metal Mfg. Co., Detroit, has been made general manager of the Bossert Corp., Utica, N. Y., succeeding the late JAMES R. JONES.

H. D. JAMES, long a consulting engineer of the Westinghouse Electric & Manufacturing Co., has opened an engineering consulting service at 1532 Gulf Bldg., Pittsburgh, Pa. The organization will offer technical information, assistance in purchasing where engineering questions are involved, cost analysis and design of equipment.

T. J. MALONEY, of the New Jersey Zinc Co., will speak on "New Product Development" before the Industrial Progress Show under auspices of the Cleveland Engineering Society at the Hotel Statler, April 11. FORREST U. WEBSTER, manager of merchandising sales, Cutler-Hammer, Inc., Milwaukee, and president of the National Industrial Advertisers Association, will talk on the subject "Developing a Market for the New Product."

ARTHUR G. HOPCRAFT has been named purchasing agent of the Cleveland Worm & Gear Co., Cleveland. He is a past president of the National Association of Purchasing Agents and of the Cleveland Purchasing Agents Association.

P. J. HOPKINS, formerly employed by the Cleveland Punch & Shear Works Co. from 1910 until he left to engage in business for himself in 1927, has returned to the company in a sales capacity.

• BUSINESS ITEMS •

Plans of the Stewart-Warner Corp. call for the removal of the Bassick Co., Bridgeport, Conn., a subsidiary, to Chicago, Ill. The Meriden, Conn., plant will also be moved to Chicago.

The Colburn Trolley Track Co., Holyoke, Mass., has been organized to succeed the Colburn Trolley Track Mfg. Co., which has been liquidated. The company will continue to manufacture conveying equipment, rolling ladders, overhead doors and sliding and fire door hardware. Officers are: president, LELAND C. ALLEN, formerly superintendent; treasurer, AUSTIN N. KIRKPATRICK; secretary, WALTER F. ZENNER, formerly chief designer.

The Geuder, Paeschke & Frey Co., Milwaukee, stamped and pressed metal division, has made the following appointments: Metropolitan district—ARNOLD L. NACKE, 50 Church St., New York, N. Y.; New England district—G. DOUGLAS MORSE, 542 High St., West Medford, Mass.; and Cleveland district—GUSTAV A. REINHARD, 1935 Euclid Ave., Cleveland, Ohio.

At a recent meeting of the Landers, Frary & Clark Co., New Britain, Conn., three new members were elected to the board as follows: DANIEL M. SHEPARD, a vice-president; RICHARD L. WHITE, treasurer, and CHARLES P. COOLEY, of Hartford, Conn.

The Allis-Chalmers Manufacturing Co. has appointed B. F. BILSLAND as manager of the Chicago district office at 20 North Wacker Drive. ARCH J. COOPER has been made assistant manager of the New York district office, 50 Church St.

The Eccles & Davies Machinery Co., Inc., has moved from 320 South San Pedro St., Los Angeles, Calif., to 1910 Santa Fe Ave., where four times the floor space is available.

The Richmond Turbine Pump Co. recently started production on electric pumps for farm and city residence use on one floor of the Knowles Tool Company Building, South 7th St., Richmond, Ind.

• OBITUARIES •

LAHMAN F. BOWER, former vice-president from 1904-1918 of the Allis-Chalmers Manufacturing Co., Milwaukee, died March 12 at the age of 75. Mr. Bower began his industrial career as superintendent of the Carlisle Manufacturing Co., becoming general manager. Later he held executive positions with the Dickinson Manufacturing Co., of Scranton, and the Jackson & Woodin Manufacturing Co. of Berwick.

THOMAS WALLACE BRYANT, chairman of the board of the Union Hardware Co., Torrington, Conn., died March 15, at the age of 74.

THOMAS LUTHER GREEN, founder and president of Thomas L. Green & Co., Indianapolis, Ind., manufacturer of baking machinery, died recently.

CHARLES W. MARSTON, associated with J. M. Marston & Co., Boston, manufacturer of power saws and general machinery, died March 10.

HARRY S. PRESSLEY, president of the Bay City Forge Co., Erie, Pa., died March 9.

EDMUND W. ZEH, founder and president of the Zeh & Hahnemann Co., Newark, N. J., manufacturer of power presses, died March 17. The firm was incorporated in 1907. He was 66.

American Machinist REFERENCE BOOK SHEET ©

Heat-Treatment of Cast Iron

Cast iron is directly comparable with steel in its reaction to heat-treatment, the only fundamental difference in the composition of the two materials being the presence of free graphite particles in gray cast iron.

Heat-treatment of cast iron may be broadly divided into three general classifications, namely, (a) annealing, (b) quenching and drawing, and (c) special heat-treatments.

Annealing

Relieving internal stresses is commonly called "aging," "normalizing" and "mild annealing," and may be accomplished by heating to from 800 to 950 deg. F., holding at this temperature from 30 min. to 5 hr. depending on section, and cooling slowly in the furnace. This treatment will cause only slight decrease in hardness, very little decomposition of cementite and will affect inherent strength properties of the metal only slightly.

Increasing time at temperature and higher temperatures progressively causes decrease in strength and hardness values of the metal. Soft iron containing large interlocking, continuous graphite particles will lose strength and hardness more rapidly than harder irons containing discontinuous graphite particles, or carbide-forming alloys such as chromium, manganese (in excess of about 0.80 per cent), and molybdenum. In general, the lower the silicon and total carbon of the metal, the less will be the decrease in hardness and strength of the iron resulting from the above heat-treatment.

Softening cast-iron for machinability is most commonly done at 1,400 to 1,500 deg. F. Highly alloyed irons are sometimes annealed at temperatures as high as 1,800 deg. F. Care should be taken to prevent oxidation of the castings. In general, softening is attended with a decrease in combined carbon and an increase in graphite content. The length of time at temperature and the maximum temperature used are the determining factors for such changes for any given metal composition. The low-silicon, low-total-carbon and graphite irons resist the breakdown of structure more than high-silicon, high-total-carbon irons and require higher temperatures and longer time at temperature to get the same degree of softening. Irons containing carbide-forming alloying elements such as chromium are also much more resistant to annealing than the straight gray irons. Completely annealed straight gray irons, that is, with no combined carbon, may have Brinell hardness values from 120 to 130, whereas completely annealed alloy irons may have Brinell values of 130 to 180 or higher, depending on the composition.

In order to obtain commercially machinable irons of high strength (from 60,000 to 90,000 lb. per sq.in. tensile strength), irons white or mottled as cast are annealed to effect the decomposition of carbides into ferrite and graphite. Such irons are commercially called "semi-malleable" and "short anneal malleable," but should not be confused with true malleable iron which is composed fundamentally of ferrite and rounded graphite particles called "temper carbon," whereas the irons described here are semi-malleable irons which contain appreciable amounts of combined carbon and frequently are fully pearlitic. The total carbon usually is held at 2.00 to 2.80 per cent, with silicon content depending on the section and not exceeding 1.80 per cent. Typical annealing cycles for this material are as follows: heat to 1,700 to 1,750 deg. F.; hold to temperature 1.5 to 3 hr.; cool to 1,375 deg. F. in 3 hr.; (a) oil quench and draw, or (b) air cool, or (c) cool slowly in furnace. The Brinell hardness of this type of iron will vary, according to the composition, from 150 to 200. Alloying elements such as nickel, molybdenum and others may be used. The resulting product has high strength with measurable ductility and good impact resistance.

Quenching and Drawing

To increase wear and abrasion resistance of cast iron, quenching from above the critical temperature is employed. Common soft gray irons that have a coarse interlocking graphite structure and a ferrite matrix are not materially improved by heat-treatment. They do not harden satisfactorily, while drawing may or may not improve the strength properties. Small castings that have a fine graphitic structure and a matrix containing a large proportion of pearlite may be improved. In the presence of high silicon, however, the heating process may decompose the silico-cementite into graphite and ferrite, causing softening instead of hardening. To heat-treat satisfactorily, the graphite flakes should be small, well distributed and should not interlock, while the matrix should be wholly pearlitic. The graphitic carbon content of suitable heat-treating cast irons should approximate 2.00 to 2.4 and the combined carbon 0.60 to 0.90 per cent.

With these conditions, gray-iron castings respond to quenching and tempering much in the same way as carbon tool steel. The hardness increases in direct relation to the rapidity of quenching from above the critical temperature. Fig. 1 shows the critical ranges of plain cast iron. Softening after hardening proceeds uniformly as the drawing temperature rises above 350 deg. F. Drawing below 350 deg. F. has little effect on the hardness. The strength properties—tensile, modulus of elasticity and impact resistance—are definitely improved as shown by Fig. 2. The effect of quenching temperature is shown by Fig. 3.

Hardening is always accompanied by an appreciable loss of strength. Recovery of the original strength is usually obtained on drawing at above 500 deg. F., and as the drawing temperature increases to 950 to 1,000 deg. F., the tensile and impact properties are improved from 20 to 50 per cent, depending on the physical constitution and the structural disposition of the graphite in the original casting.

Abstracted from "Symposium on Cast Iron" published jointly by the American Foundrymen's Association and the American Society for Testing Materials, and presented at a joint meeting at Chicago, Ill., June 26, 1933.

Heat-Treatment of Cast Iron

(Continued)

The castings should be heated slowly and uniformly to the quenching temperature. They should be held at the quenching temperature a sufficient length of time to insure that all parts are at the maximum or quenching temperature. A safe minimum is 30 min. for comparatively small castings. The castings, if small and of symmetrical design, may be preheated to 300 to 500 deg. F. in one furnace and then transferred to another that is held at the quenching temperature with little danger of cracking, to promote economy of operation.

The quenching temperatures used on most irons is from 1,450 to 1,550 deg. F. Oil is most commonly used as a quenching medium, but this depends on the composition of the metal. With some compositions the castings may be quenched in an air blast or still air. Manganese lowers the transformation point during the heating period, particularly when the manganese content reaches 2 per cent. A marked effect on quenching is also noticeable when irons have 1 per cent manganese and from 1 to 2 per cent nickel.

Brinell hardness values up to 600 may be obtained by hardening, depending on the composition of the metal employed. The alloying elements nickel, molybdenum and manganese lower the critical transformation points on cooling while chromium increases them. The final hardness values obtained are dependent on the average hardness of the matrix and the graphite particles present. The size, shape and distribution of the graphite particles are extremely important. The metal may be completely or partially annealed before hardening without appreciably affecting the response to quenching or hardening properties, provided coarse interlocking graphite is not present.

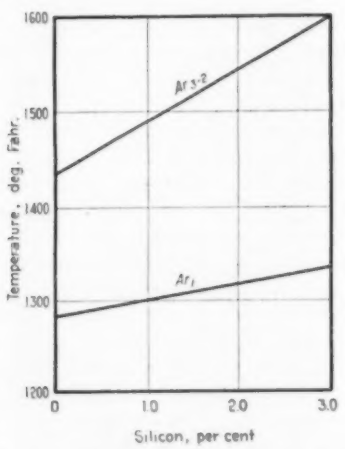


Fig. 1—Critical ranges of plant cast iron containing 3.3 per cent total carbon.

Nitriding

The nitriding process is comparatively new in the heat-treating of cast iron. It is used to obtain surface hardness on a finish machined casting of from 800 to 960 Brinell. Low total carbon, chromium, aluminum irons were originally developed for nitriding purposes, being somewhat similar to the steels used for nitriding treatment. It is said that chromium-vanadium irons also respond to nitriding satisfactorily. Nickel also is used in nitriding irons.

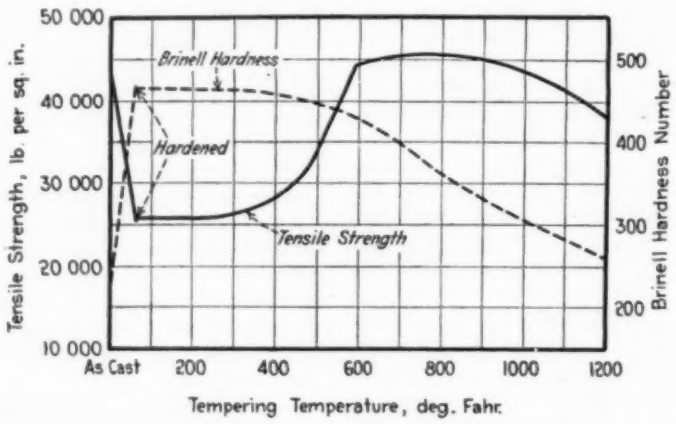


Fig. 2—Effects of tempering temperatures on the properties of cast iron

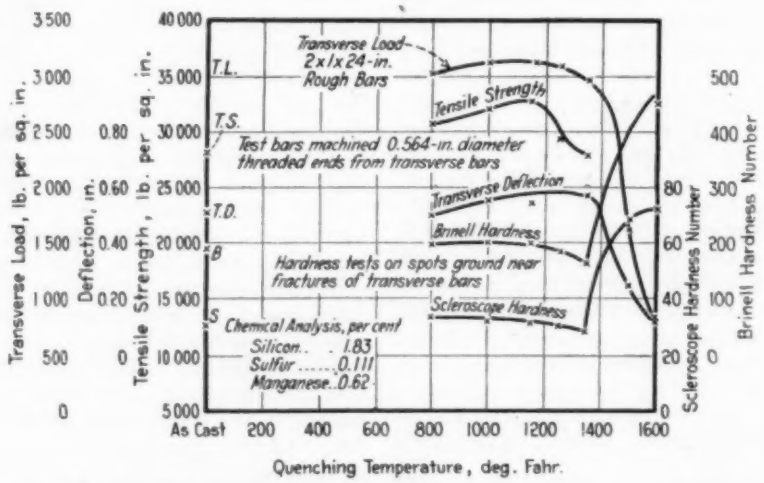


Fig. 3—Effects of quenching temperatures on the properties of cast iron (Harper and MacPherran). Test specimens held at temperature 1 hr. before quenching in water

THE ROUND TABLE

NRA and the Small Shop

"Well, Al," said Ed, as the two finished their lunch together, "you've been working under your NRA code about six months now. Is it a good thing or not?"

"That's pretty hard to answer with 'yes' or 'no,' Ed. The code has done some good things—prohibiting child labor, for instance. I'll even go along with it on shorter hours up to a certain point, but as a small manufacturer, I'm afraid it will work against me in the long run."

"How's that, Al? I thought the Administration was all for the little fellow."

"Theoretically, yes; but practically the big fellow can take advantage of the code to a much greater degree. He can hire legal talent to advise him how he can profit most by provisions of the law. He can send his best men to Washington to help draw up the code, attend its hearings and later sit on the code authority."

"I always understood that the small manufacturer had just as much right to be heard and represented as anyone else."

"Yes, Ed, he has the right, but not the time. Take my own case. I'm in the throes of putting across a new compressor. It looks good but it has plenty of loose ends to be taken care of from an engineering and manufacturing viewpoint. I can't run down to Washington every other week. Even the little fellows who sacrifice their time and money at the start won't be able to keep it up."

"But, Al, doesn't the government see to it that the small shop is protected in the codes?"

"Not if you can judge by some of the provisions. The small shop's only justification for existence is that it is enterprising and quick to profit by new methods and new ideas. The codes tend to freeze things as they are, whereas the little fellow must take advantage of changing conditions. If this opportunity is removed his chief stock in trade is gone."

"I don't see that, Al. Many of the codes have cut out price differentials on quantity purchases. That means that the large corporation won't have the big advantage it had before in buying materials."

"True, but if the little fellow cuts his costs and sells for less he's called a chiseler. Most of the codes require him to file prices from 10 to 30 days before he can change them. This gives his big competitor a chance to meet his prices or cut below them. The small shop's whole production may be only a side line with some big outfit but they'll squeeze him out if he tries to do business on a price basis. It all favors the old-line, well established concern."

"Well, Al, you know that's to eliminate the cutthroat competition that's been going on the last few years. That didn't get us anywhere but deeper into the red ink. And in the end it came out of the workingman's pocket."

"Well, take another angle. We all have to file statistics with the code authority which lets the big operators know just what the little ones are doing. Ordinarily the small shop makes a living by being one jump ahead and now that advantage is lost."

"But it doesn't destroy his initiative so far as I can see. He has still an opportunity to develop new products and grow in size."

"Not in some industries, Ed. Where there is a so-called 'control-of-production' clause, a committee must pass on new equipment for expansion. Since the committee members are usually competitors, the little fellow's growth is stunted and the normal replacement of old decadent concerns by new enterprising ones is halted. That can lead only to industrial stagnation."

Will the National Recovery Act militate against the small shop? How can the small manufacturer retain his inherent advantages when operating under a code?

Discussion

What Share?

Ed had a right to be "balled up" at Al's question. That is a problem that men have been discussing since the industrial era began, if not before. But I don't at all agree with Al in his parting shot at the unreasonableness of labor, that they want a long shot rather than justice. Did Al feel that way when he was at the bench?

Al says the stockholder takes a chance of not getting his pay. So did he when he put it in a bank in the good old days when over 10,000 of them folded up. And what will he do with his capital if he doesn't invest it. Unless someone wants to use it he finds capital is a liability instead of an asset because he has to pay for its protection. That is one of the penalties of accumulating wealth of any kind. One of our troubles has been that capital expected, and got, most of the earnings. The men who used it, and by so doing made it of value, got mighty little in many cases.

The trouble with Al's point of view is that he forgets that capital has no earning value unless it is used. It is simply a tool to be used by labor and

management in the making of its product. And those who supply this particular tool, which has no earning power unless it is so used, are certainly not entitled to the lion's share of the earnings. Management and men give mental and physical labor. Capital supplies what would otherwise be a liability, and will have to be satisfied with a small return.

—CHAS. F. HENRY.

Honest labor's share in industry is positive assurance of a good permanent living for himself and his family with his declining years provided for through adequate pay from which he can save for his old age or, for those having holes in their pockets, a practical cooperative pension. The opportunity to advance or improve his position should be entirely dependent on his energies, intelligence or superior abilities. It should never be through internal political wire-pulling, family relationships, friendships, nor boot-licking with the higher-ups.

A firm can be fair by being just that. It should have a head and operating executives who are human, honest and have ordinary intelligence and decency supplemented by the desire to play the game fairly and squarely. Honest labor will always get a square deal from this kind of a line-up. Any firm having a mistake for its head, with the same type for its first and second assistant heads and sorely infested and overburdened with in-laws and more distant relatives of these mistakes can never be fair to its workers because "the firm," or more properly "the mistakes" mismanaging it, have distorted ideas of the relative importance of these unwanted-elsewhere executives and industrious constructive workers.

—E. E. GAGNON,
Mechanical Superintendent.

No Inventory

Annual physical inventories, like spring cleaning, used to be thought a necessary evil. Most men would like to avoid the mess and upset of spring cleaning by moving to a hotel during its duration. We can't avoid inventories that way, but they can be made painless. Under present conditions annual inventories are even harder than ever to arrange because employees cannot work overtime because of NRA, many green employees have been hired who require supervision to insure inventory accuracy, customers are more insistent than ever on prompt deliveries and do not accept delay due to inventory as an excuse.

In many industries plants cannot be shut down as a whole or started up again at one time. Here at the American Hard Rubber Company, which makes over 20,000 sundry or jobbing items, plus thousands of stock items, and has on hand thousands of models and dies, the problem is serious.

The production and accounting departments are working out a plan to take most of the headaches out of inventory taking. A blueprint of each of the five largest stockrooms has been made, allowing a square for each shelf, bin, pile, etc. This square is large enough to accommodate four or five date stamps. Each day a number of items are checked physically and the date is stamped in the square for that item. Each item is to be checked four or five times a year. Several times a year the accounting department will check these blueprints to see that the system is being properly carried out. Whereas it formerly took about 30 people two days to take an inventory in one storeroom the storekeeper can now take it alone in the course of the year.

This scheme not only saves trouble at inventory time but aids the production department throughout the year. In spite of the variety of product some items must be shipped the same day the order are received. Some of these items take some weeks to make and assemble, so an inventory that straightened records once a year would not be entirely effective in preventing delivery holdups because the stock had run out or the material had been misplaced.

—BERNARD SHEREFF, *Engineer,*
American Hard Rubber Company.

Loss of time during inventory is a destructive bugaboo in any plant large or small. As a general rule production stops while it is being taken. In many plants for a month or more before inventory-taking date all purchasing is stopped unless it is entirely impossible to do without the item requested. This results in delays and costly substitutions.

A plant making one or several sizes of the same product should never need to take an inventory. A plant doing a jobbing business or working along specialized or custom built lines may feel the need of inventory at times but still it should not be absolutely necessary.

The installation and use of a perpetual inventory coupled with careful stock keeping will be of more service and actually reveal the true conditions on any date. This kind of system will show what stock or material came in. The amount of finished product or spare parts shipped out. It will show how many parts and how much material is on hand and in what condition. No inventory, regardless of how accurately made, will show more.

In Al's business he does not need a periodical inventory. His line is not varied but repetitive. He needs about a certain flow of finished product to fill his orders. He has his time cycle worked out to such an extent that he knows his material requirements. He does not buy more or less than his time cycle shows that the business needs, so what more could an annual inventory tell him than he already knows?

—L. O. BROWN.

Averaged Dividends?

The word "surplus" as applied to a corporation's financial structure, can have many interpretations, many of which depend on the method of accounting. In the strictest sense of the word, "surplus" is the net amount of moneys remaining after all inherent expenses have been taken care of. This applies especially to the face value of all outstanding shares of the firm.

In some states, notably California, a surplus can only be considered as such if it is derived as earned income. In states where the law is not so drastic surplus may be the result of, for instance, the increase in land or building values over an extended period. In other words, this apparent rise in worth is capitalized and placed in the structure as an asset. It is, therefore, obvious that there is no set relation between surplus and dividends, for, if the amount of surplus becomes of such magnitude that a major part would go to the government as one of the forms of income tax, those in authority find it desirable either to declare extra dividends or split the prevailing stock into units of lower par value.

The idea of a constant dividend rate is not entirely new, for it has been used by some of the more conservative companies for many years. From an investment viewpoint it has many of the advantages of a preferred stock issue. The element of gamble, or in other words, speculation, is almost entirely eliminated with this form of financing. For those who are looking for a proposition approaching a get-rich-quick incentive, it has no appeal. Those who invest in a corporation which has for a basis a five-year accumulated dividend plan have more or less the assurance that the same rate will be paid in lean as well as good years.

In the case of a corporation about to be formed, the investor must be prepared to wait for the income from his investment over an extended period. The reason why this sort of financing has not met with general approval in past years is because of a psychological complex on the part of most of the investors which has crystallized their judgment on a questionable anticipation of quick profits with the willingness of taking all chances on the ultimate outcome.

—HAROLD L. WYNN, *Executive Engineer,*
Pacific Electric Mfg. Corporation.

• IDEAS •
FROM PRACTICAL MEN

Oscillating Hopper for Filling a Magazine Tube

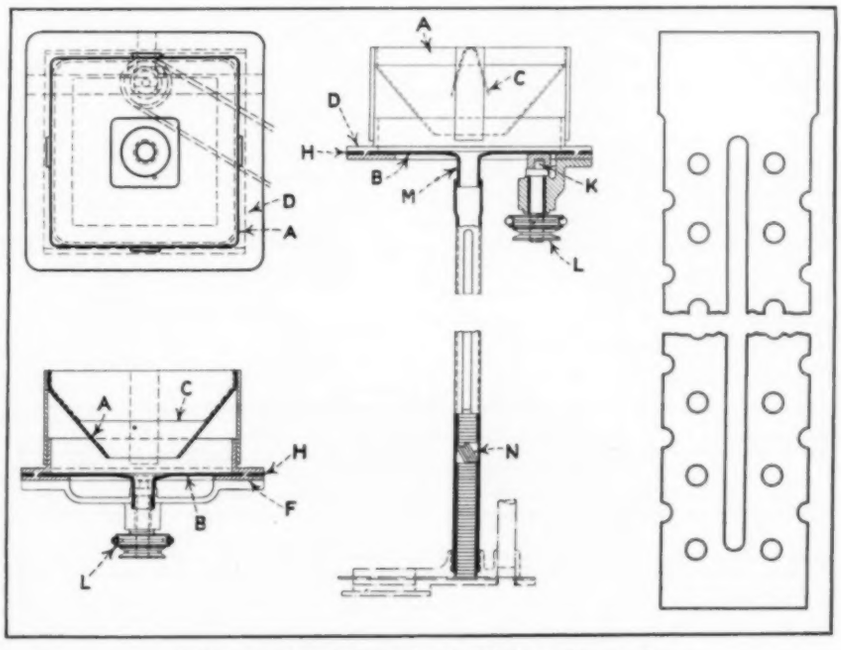
JOSEPH WAITKUS

In a certain machine, shells were to be fed at the rate of six per second and it was necessary to deposit a disk of special material into each shell at the same rate. Obviously, at such very high rates of feeding it is necessary to have a substantial supply of material in the magazine chamber. Furthermore, this material must flow steadily and be arranged in an orderly manner.

The illustration shows the arrangement for feeding the disks to the magazine tube, which, in turn, feeds the mechanism for depositing the disks in the shells. The disks are thrown into the hopper *A* and drop through an opening in the bottom onto the oscillating plate *B*. The rib *C* takes a great deal of the weight of the disks from the oscillating plate *B*, its shape being such as to furnish sufficient area to support the piles of disks without interfering with their dropping to the oscillating plate. This feature aids the smooth flow of disks to the magazine tube, otherwise clogging at the tube mouth would frequently occur.

The hopper is supported by legs attached to the ring *D*. The plate ring *F* is rigidly attached to the machine and carries the entire weight of the hopper. A filler piece *H* retained between the rings *D* and *F* permits the oscillating plate to have free motion in one line. The oscillating plate is actuated by the crankpin *K* working in a slot in a block attached to the plate, the crankshaft being driven by the pulley *L* through a belt. As developed in sheet metal, the magazine tube is shown at the right. It has a long slot and numerous observation holes, and is rolled into a tube and brazed. The lower end of the tube fits loosely into an opening in the feeding mechanism and rests on a shoulder on the inside of the opening. The upper end of the tube is slightly enlarged and fits loosely over the nozzle *M*, which is part of the oscillating plate.

Motion of the oscillating plate causes the tube to move in line with the plate and to rotate slowly. The rotating motion is a very important feature, as it brings the disks eventually into a position where the oscillating movement is most effective in causing them to settle down into a horizontal plane and prevents the condition shown at *N*. If for any reason the disks should fall into this position, the slot and the holes in the magazine tube will help to correct the situation. However, if the oscillations are of high enough frequency (about 500 per min.) no trouble need be experienced. In the particular machine for which this device was designed, the magazine tube had to be filled to the top before the machine was started, assuring a sufficient supply of disks at the high speed at which the machine was run.

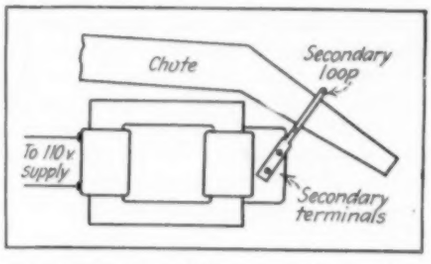


The magazine tube is kept filled by the oscillations of a plate at the bottom of the hopper

A Demagnetizer for Mass Production

E. KENNEDY

Labor necessary in placing individual parts on the platen of a demagnetizer may be eliminated by the simple arrangement shown in the illustration. We took the transformer out of an unused electric welder and connected it up as shown. To the secondary terminals we attached a three-turn rectangular coil of wire. Any size wire or strip is suitable as long as the coil or loop will carry current enough to demagnetize instantly any mass of parts that may be run through it.



This device will demagnetize small parts as they run through the chute

A chute of either sheet metal or wood, is placed at the proper angle and position and the loop arranged accordingly. The only thing necessary is to turn on the switch or lamp socket and to place the parts in the chute, allowing them to fall or slide through the loop. Large parts, such as dies and tools are demagnetized as readily as small parts.

The same results, in a slightly modified form, may be obtained without in any way disturbing a spot welder if one is available. Close the electrodes so that the two tips come together as in the process of spot welding. Passing articles between the arms of the two electrodes when the tips are together demagnetizes them.

To Inspect or Not to Inspect?

E. H. FISH

The question of inspection seems to hang largely on the size of the shop. Where a hundred workmen are turning out the same product there can be no hope of uniformity without a centralized inspection with definite standards. But in a small shop there is usually much work that is best passed on by the workman himself, unless he happens to be on piecework, in which case the foreman can readily check up.

I am minded of a case in a die casting shop where I was employed. We had certain castings which were being made in dies which were O.K. where all we did was to shovel the castings into the scoop of a counting scale and pack them for shipment. If there were any bad ones the recipient did not think it worth while to kick. At the same time we were running another die that was in trouble most of the time. To get the first thousand pieces to send out I had to wade through about 7,000 castings. Of course there was no money made at that rate, but the customer wanted the castings and could not wait for us to perfect the die.

It seems to me that common horse sense should determine what to inspect and what not to inspect. If as in a grinding wheel shop, thousands of pieces are put in a kiln, sealed up and burned for two or three weeks, with almost no chance to guess what is really going on, then when the product comes out the merest curiosity dictates inspection before any more work is put into the lot.

Let's not try to lay down any hard and fast rule.

Milling From Two Radii

WILLIAM M. HALLIDAY
Idle, Bradford, Yorkshire, England

We had to make large quantities of parts such as the one shown in Fig. 1. While the essential shape only is shown, it will be seen that to mill the edge *A* and the V-groove *B* it was necessary to work from two radii. Moreover, the two arcs had to be smoothly joined.

The fixture for machining the parts is shown in Fig. 2. The bracket *A* is attached to the column of the milling machine and the plate *B* is pivoted to it at *C*. Pivoted to this plate at *D* is the work-holding nest *E*, and attached to the plate is a stud carrying the cam roller *H*. The cam *I* is attached to the table of the machine and travels with it. The nest, the work and the lever *K* are all keyed to the shaft on which the nest and the work pivot. The work is further confined in the nest by setscrews, and the nest is limited in its motion by the stop pins *L* and *M*. A tension spring attached to the lever *K*, assisted by the weight of the nest, the work and the downward pressure of the cut, keeps the nest against the stop pin *M* while the arc of long radius is being milled.

When the table of the machine is fed from right to left, the cam swings the plate *B* upward by means of the roller traveling on the incline, thus milling the arc of long radius. When the roller reaches the end of the incline on the cam, lever *K* contacts with the stud *N* in the cam and forces the nest and the work to swing upward from the pivot *D*, milling the arc of short radius. The edge is milled with a slabbing cutter, the cutter being changed to one for milling the V-groove in a second operation.

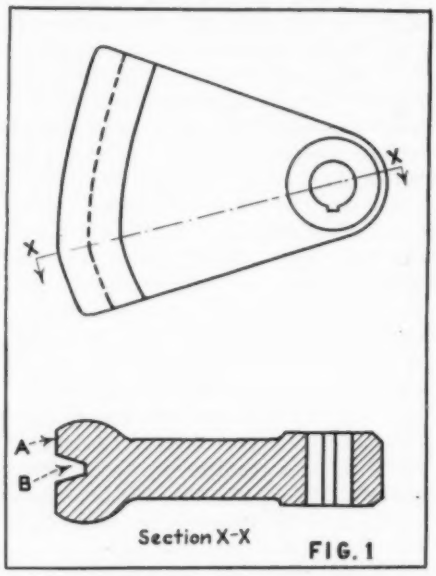


Fig. 1—This piece had to be milled with two different arcs

Milling Helical Grooves in Long Shafts

EMIL WITTMANN

Recently, we had to mill a helical groove having a lead of 18 ft. in each of a number of long shafts. As the shafts were too long to go between the centers of our universal milling machine, it was decided to do the work in the lathe. Accordingly the rigging illustrated was attached to the carriage after the toolblock had been removed.

A large electric drill with the handle removed, and carrying an end mill, was attached by leather-lined clamps to an angle plate, the whole being mounted on a plate blocked up on the carriage to bring the end mill to center height. A bushing in a hole in the angle plate served to support the end mill by its shank. The sleeve *A*, having a helical groove of the correct lead, was attached to the tailstock end of the shaft by three screws, the shaft being held between and revolving freely on ballbearing centers.

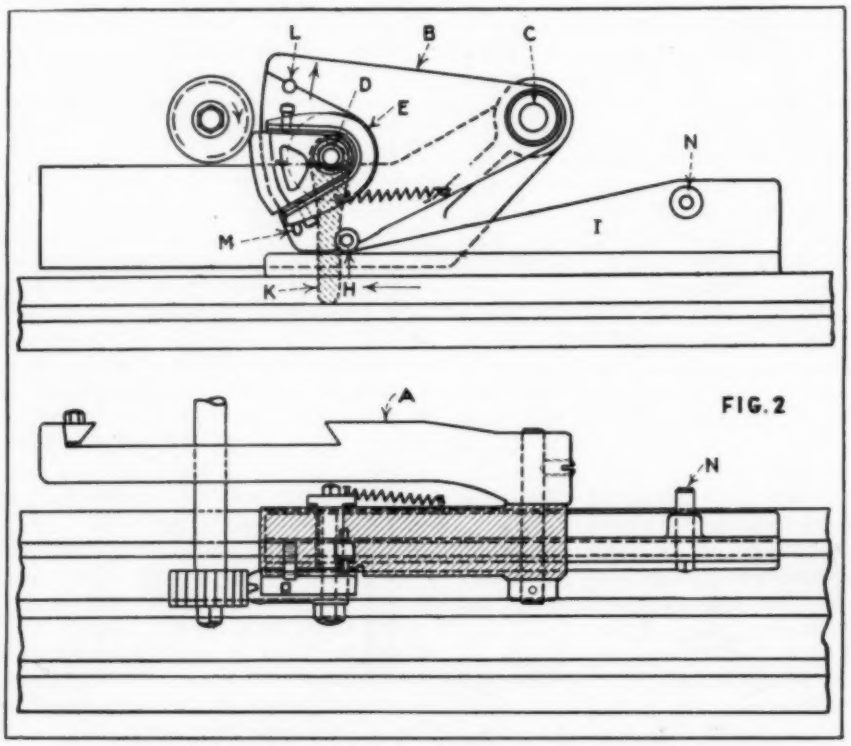
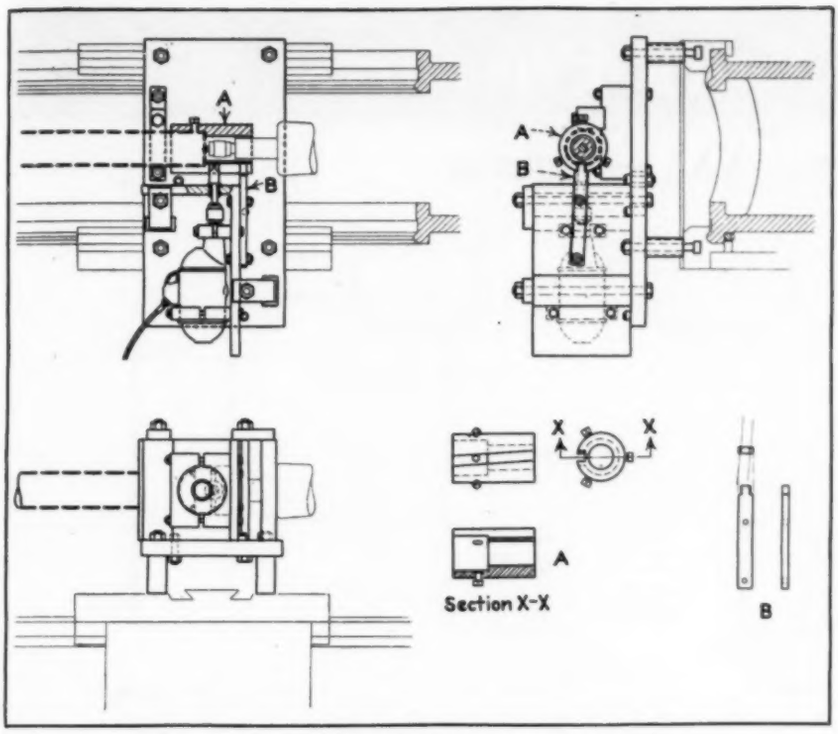


Fig. 2—Milling the two radii was made easy by this fixture where each cut swings from its own center



A large electric drill rigged on the lathe carriage milled a lead of 18 ft. on a number of long shafts

The former pin *B* was attached to one side of the angle plate and engaged the helical groove in the sleeve.

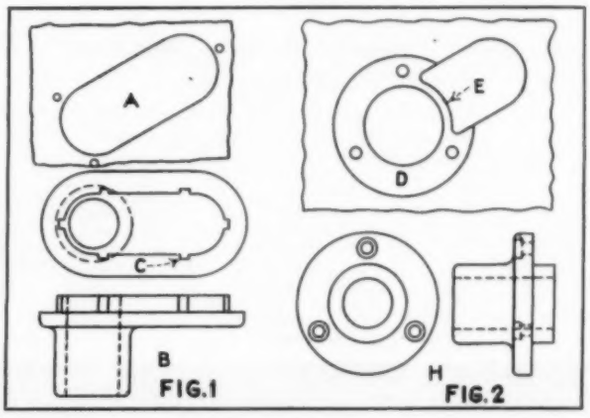
In starting the operation, the electric drill and the lathe were started and the longitudinal feed of the carriage was engaged. With the shaft revolving freely on the centers and the former pin engaging the helical groove in the sleeve, the longitudinal feed caused the shaft to rotate so that the end mill cut a groove of the correct lead. As the feeding movement of the carriage progressed, the former pin slid out of engagement with the groove in the sleeve and entered the groove in the shaft, just behind the end mill. Thus a helix of the correct lead was generated.

Making Bearings Interchangeable

MATTHEW HARRIS

In a certain line of machines, one of the side frames had a slot, as at *A* Fig. 1, cored in it for the introduction of a crankshaft. The bearing for the crankshaft is shown at *B*. It was fitted to the slot by filing the projections *C* and was held in place by three screws. No machine work was required other than boring the hole for the crankshaft and drilling the holes for the screws. After the bearing was in place it was bored in a jig along with other holes. The crankshaft bearing in the other side frame was an integral part of the frame. While this method was all right for each individual machine, it was impossible to furnish bearings for repairs that were interchangeable.

The pattern was altered as in Fig. 2. The pad *D* was added and the web *E* separated the cored hole from the slot. In machining the side frame, the pad *D* is face milled at the same setting with other bosses and the cored hole is bored in a jig along with other holes. After the hole has been bored the web *E* is cut away with a hacksaw, leaving a sufficient opening for the introduction of the crankshaft and leaving about two-thirds of the hole as a seat for the bearing. The bearing, shown at *H*, is a simple job for the turret lathe and is interchangeable. No attempt was made to entirely cover the slot as the small opening was not objectionable.



A simple alteration in the bearing patterns made the bearings interchangeable

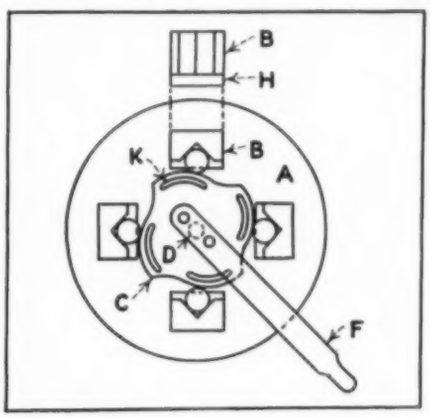
Drill Jig for Use with Multiple Drilling Head

JOHN E. HYLER

For clamping several cylindrical pieces to be drilled by drills held in a multiple drill head, the one-motion-clamping jig illustrated will be found very convenient. It consists of the circular base *A* to which the four V-blocks *B* are attached; the clamping cam *C* pivoted at *D;* and the lever *F* for rotating the cam.

The V-blocks are so positioned as to center the cylindrical pieces under the four drills in the drill head, and their extended bases *H* permit the chips to be readily brushed off. The cam is provided with four slots *K* following the same contours as those of the lobes. These slots permit a small amount of yield or spring to the cam lobes as clamping takes place, equalizing the pressure irrespective of any small differences in the diameters of the workpieces. This yelding action can be increased or decreased by locating the slots nearer to or farther from the surfaces of the lobes.

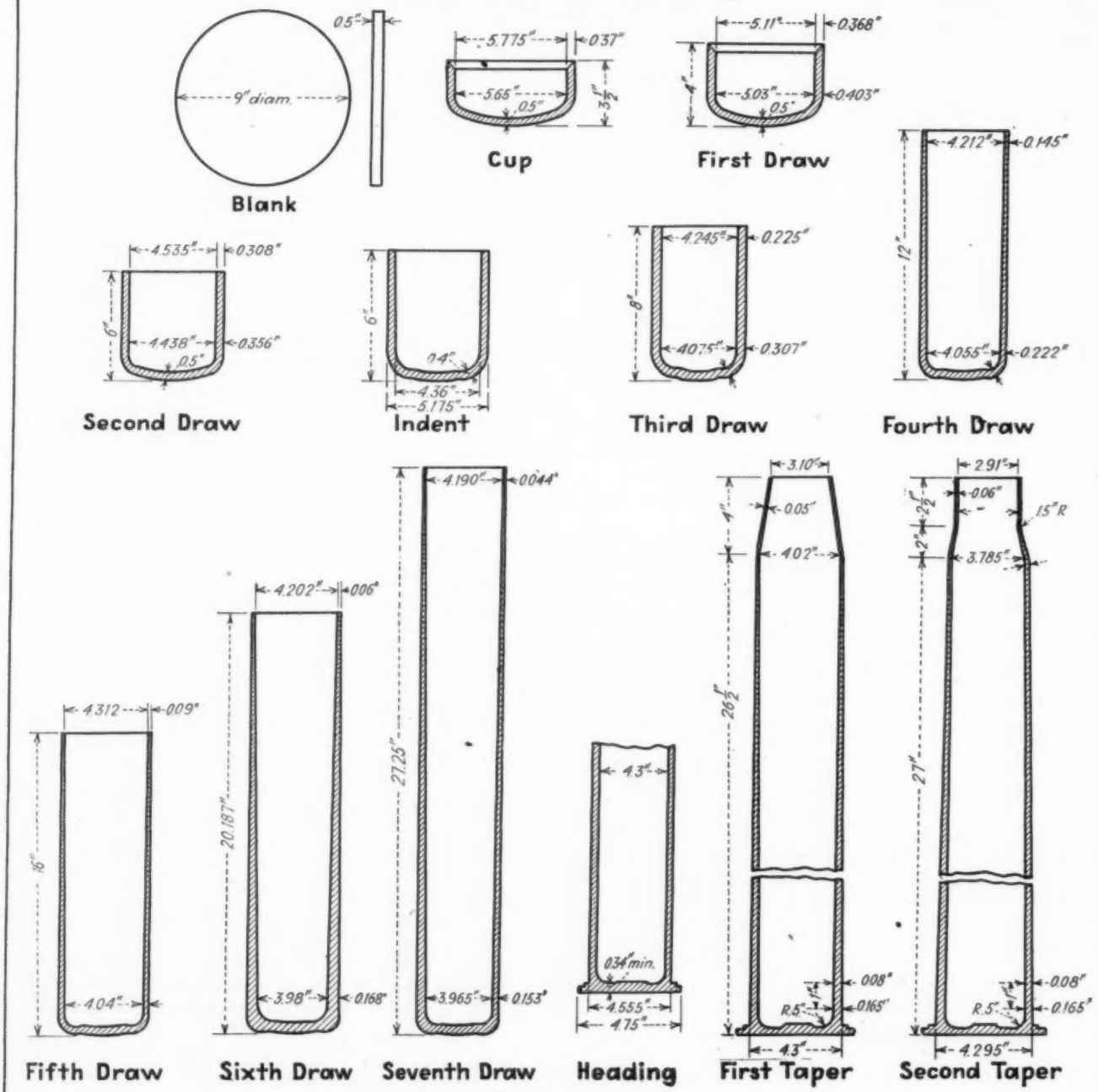
For handling work of different diameters, the V-blocks can be mounted in slides so as to be readily adjusted, and cams of different sizes can be used.



The slots in the cam lobes permit the lobes to yield slightly in clamping, equalizing the pressure

Press Work Pressures

Series XXX—*Drawing*



Operation--Draw a cartridge case

Material--Brass, 0.50 in. thick by 9 in. in diameter

Pressure--Cup -	150 tons	
First draw -	125	
Second draw -	100	
Indent -	1,000	Note: Piece annealed after each draw and twice at the mouth, first after heading and again after the first taper
Third draw -	100	
Fourth draw -	75	
Fifth draw -	75	
Sixth draw -	65	
Seventh draw -	55	
Heading -	1,500	
First taper -	60	
Second taper -	55	

Contributed by C. W. LUCAS

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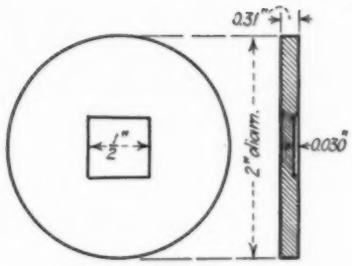
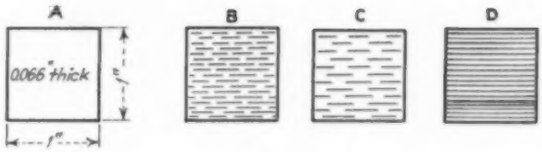
Press Work Pressures

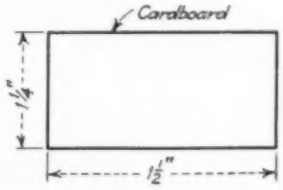
Series XXXI—*Coining*



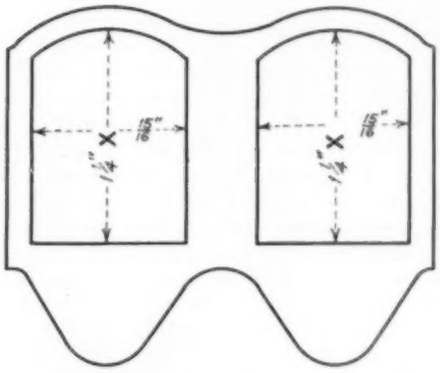
Material--Hard phosphor bronze, 0.31 in. thick by 2 in. diameter
Operation--Mash 1/2x1/2 in. depression in center to a depth of
A-0.030 in. B-0.029 in.
Pressure--A-35 tons B-50 tons



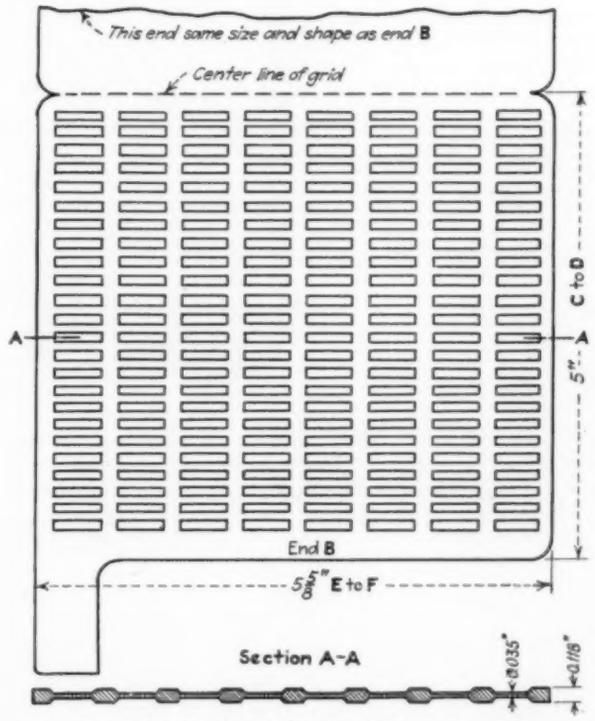
Material--Fiber - 0.066 in. thick
Operation--Piece A original.
Piece B was soaked in cold water 3 min. then placed between damp cloths and allowed to remain over night, thickened up from 0.066 in. to 0.088 in.
Piece C embossed when dry.
Piece D embossed when dry.
Pieces B, C and D coined 0.005 in. deep
Pressure--B-4,000 lb. C-6,000 lb. D-10,000 lb.



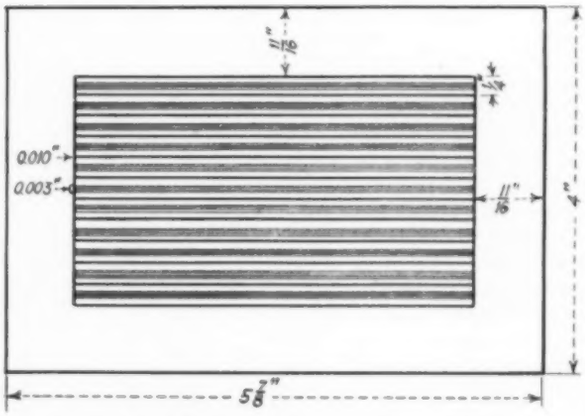
Material--Cardboard, 0.046 in. thick
Operation--Compress to 0.036 in. thick
Pressure--10,000 lb.



Material--Brass, 0.041 in. thick
Operation--Coin the two panels marked x - x 0.015 in. deep
Pressure--300,000 lb.



Material--Zinc, 0.118 in. thick
Operation--Mash grid 0.026 in., without confining it on the sides.
Grid lengthened 1/64 from E to F and 1/32 in. from C to D
Pressure--80,000 lb.



Material--Brass plate
Operation--Coin as shown -
Light lines 0.003 in. deep
Heavy lines 0.010 in. deep
Note:- Coin mark 1 in. long by 0.010 in. deep required 4,000 lb. in another test
Pressure--250 tons

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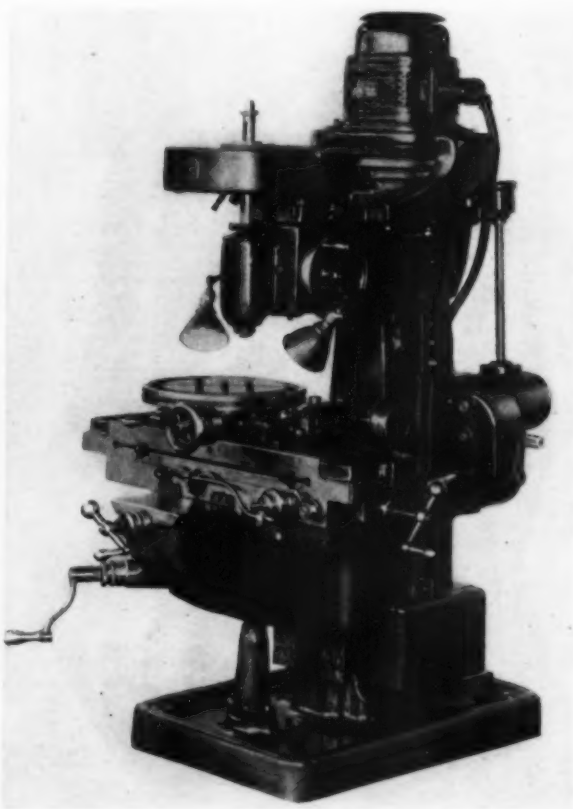
SHOP EQUIPMENT NEWS

Reed-Prentice No. 3V Vertical Milling and Die-Sinking Machine

Vertical motor drive is used on the No. 3V vertical milling and die-sinking machine offered by the Reed-Prentice Corp., Worcester, Mass. The vertical ball-bearing motor is carried in a bracket fitted to the slide, and the bracket is adjustable for belt tension and changes in spindle speeds. Drive is through an endless V-belt. A four-step spindle and motor pulleys provide ten spindle speeds. Ordinarily, 1,800- or 1,200-r.p.m. motors are used. With the 1,800 r.p.m. motor speeds of 600 to 4,000 r.p.m. are available; with the 1,200 r.p.m. motor from 395 to 2,630 r.p.m. Where slower speeds are required a 900-r.p.m. motor may be used.

Feed is taken directly from the motor through helical gears and a vertical shaft to the gearbox. Six feeds are available for each spindle speed with maximum and minimum longitudinal feeds of 0.047 and 0.0004 in. per revolution. Longitudinal feeds per minute with an 1,800-r.p.m. motor are 1.75 to 28 in.; with a 1,200-r.p.m. motor, 1.15 to 18½ in. Standard equipment includes the machine arranged for vertical motor drive but exclusive of electrical equipment, 5-in. plain base vise, draw-bar, 2A or 3 Becker collet adapter, one collet and wrenches.

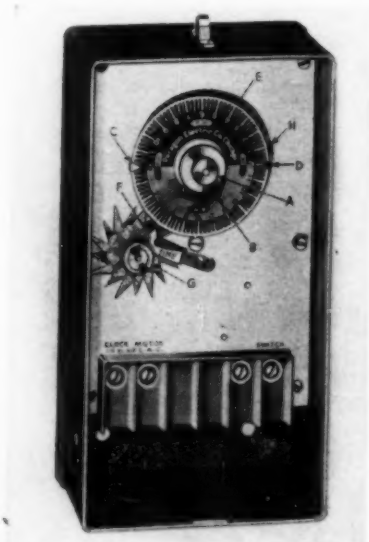
Machine specifications are: Longitudinal power feed, 21 in.; cross feed, 12 in.; vertical feed of knee, 16½ in.; head travel, 3½ in.; maximum distance from spindle to table, 16½ in.; maximum distance from spindle to rotary table, 12 in.; maximum distance from spindle to frame, 16 in.; diameter of rotary-table working surface, 16½ in.; machine-table working surface, 10¼x 30¾ in.; shipping weight, 2,850 lb.



Any one of three spindle-speed ranges can be had by use of either an 1,800-, 1,200- or 900-r.p.m. vertical motor. Ten spindle speeds in any range. Feed is taken from motor by helical gears, vertical shaft and gearbox. Six feeds per spindle speed.

Paragon Type G Time Switch

A compact and simplified time switch, known as the Type G Series, is being offered by the Paragon Electric Co., 407 South Dearborn St., Chicago, Ill. The switch is 8 in. high by 4 in. wide by 3 in. deep. It is a self-starting, synchronous type for use on any circuit not exceeding 1600 watts. The movement contains only four brass wheels and

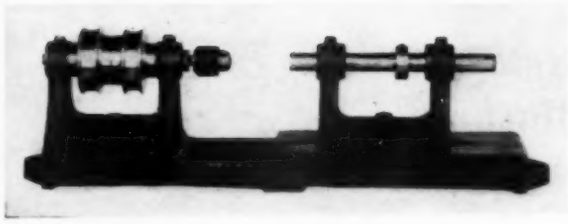


steel pinions. A skip trip provides for manually turning the circuit on or off at any time ahead of the automatic setting without disturbing the normal sequence of operation. The switch is offered for a.c. single-pole, single throw; single pole, double-throw, or any special two-circuit application.

"Wearweld" Hard-Surfacing Electrode for Steel

The Lincoln Electric Co., Cleveland, Ohio, is now distributing "Wearweld" shielded-arc electrode for building up steel surfaces to resist shock and abrasion. Deposits made with this electrode

are air-hardening alloy steel combining hardness and toughness. The electrode can be used to build up all steels other than those of the austenitic type. A single layer on mild steel has a hardness of 40 to 45 Rockwell C., and additional layers will have a hardness of 48 to 52 Rockwell C. Two sizes of electrodes are manufactured, ¼ and ⅜ in. by 18 in. long. The electrode is packed in 50-lb. containers.



Langelier Bench Tapping Machine for light work in optical, radio and electrical trades

Langelier Horizontal Bench Tapping Machine

For small light tapping operations in optical, radio, electrical and jewelry parts, the Langelier Manufacturing Co., Providence, R. I., is offering its improved bench tapping machine that combines sensitiveness and ease of operation. The spindle is equipped with a No. 1 Jacobs chuck and has a capacity of ⅛ in. in sheet metal. Drive is by means of open and crossed belts through a friction clutch, the spindle running inside a bronze sleeve on which the pulleys are mounted to eliminate any belt pull on the spindle. A tailstock is provided with a shaft having a tapered socket so that fixtures can be used if necessary to align the work on the tap. Distance from the bed to the center of the spindle is 3¼ in., and the bench space required is 22 x 4 in.

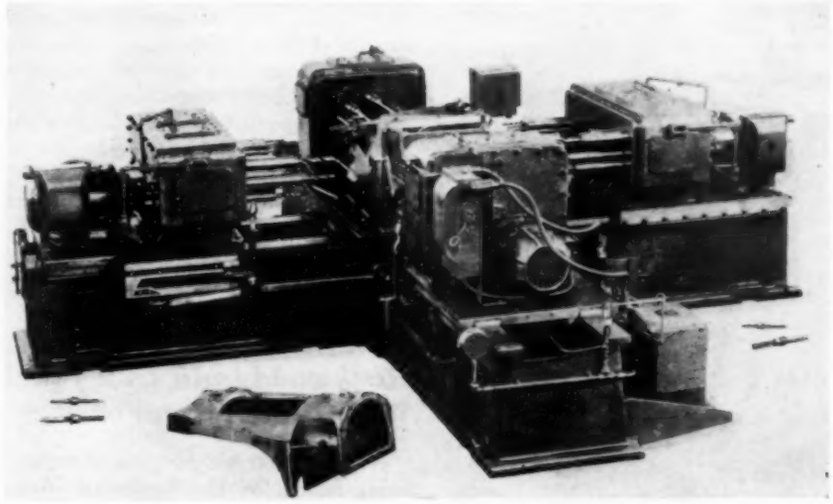
Baldor "Flex-Align" Coupling

The Baldor Electric Co., 4357 Duncan St., St. Louis, Mo., has announced development of a "Flex-Align" coupling designed to take care of large misalignments and to absorb vibration. Special rubberized fabric driving members are employed. The motor may be coupled

so close to the driven appliance that the shaft ends almost touch. Each part is held to the shaft with two setscrews placed at 90 deg. The coupling will run in either direction without backlash. Three sizes are built for 1/3, 1 and 3 hp., at 1,725 r.p.m.

Defiance Four-Way Horizontal Drilling and Reaming Machine

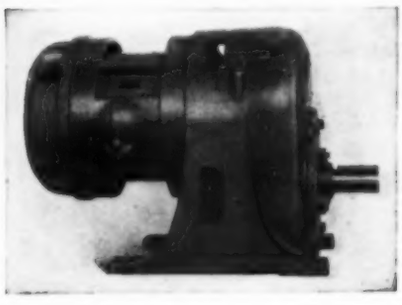
The Defiance Machine Works, Defiance, Ohio, recently built an extra-heavy, four-way horizontal drilling and reaming machine with multiple-spindle heads, equipped for drilling and reaming 53 holes in main front tractor frames. A center member in the base holds the fixture, and to this center member are attached four separate members which carry the slides upon which the multiple-spindle heads and motors are mounted. Heads are mounted at right angles on the machine and are opposed in both directions. They are inclosed and have force-feed lubrication and direct-connected motor drives. Box-type construction is used for the fixture, which is equipped with guide bushings for drilling and reaming tools, and with quick-acting screw clamps for locating and holding the frames in position. Two separate Oilgear pumps and cylinders are used for feed. Each pump drives two opposed heads and the machine is so arranged that either two or four heads are in work at the same time. Each opposed set of heads is equipped with a cut-steel rack and pinion for timing. Net weight of the machine is 35,000 lb., and floor space occupied is 16 ft. 6 in. by 15 ft. 4 in. Plain or anti-friction bearings may be had.



The main front tractor frame shown has 53 holes drilled and reamed on this Defiance four-way hydraulic machine

Reliance Type "S" Single-Reduction Gearmotors

Single-reduction gearmotors in ratios up to 6 to 1 inclusive are now available from the Reliance Electric & Engineering Co., 1042 Ivanhoe Rd., Cleveland, Ohio. These gearmotors can be furnished with a.c. or d.c. motors of various types in sizes from ¾ hp. and up. Multi-speed and adjustable-speed motors may be used. The entire reduction is obtained in a single pair of gears.



Lees-Bradner Helical-Gear Lead Testing Machine

The Lees-Bradner Co., Cleveland, Ohio, announces a machine which not only accurately measures the helix angles or the lead of helical gears, but in addition actually calibrates the machine settings. The method of measuring helical gears is one in which a point of contact with the gear tooth is moved relative thereto across the gear face and at a uniform distance from the gear axis, while imparting to the gear being tested an angular or rotative motion equal in extent to one complete revolution while the contact point is moved through the exact distance of the lead. The lead of a gear is a constant quantity no matter where on the tooth measurements may be taken. Hence, when the lead is found to be correct the helix angles must of necessity also be correct.

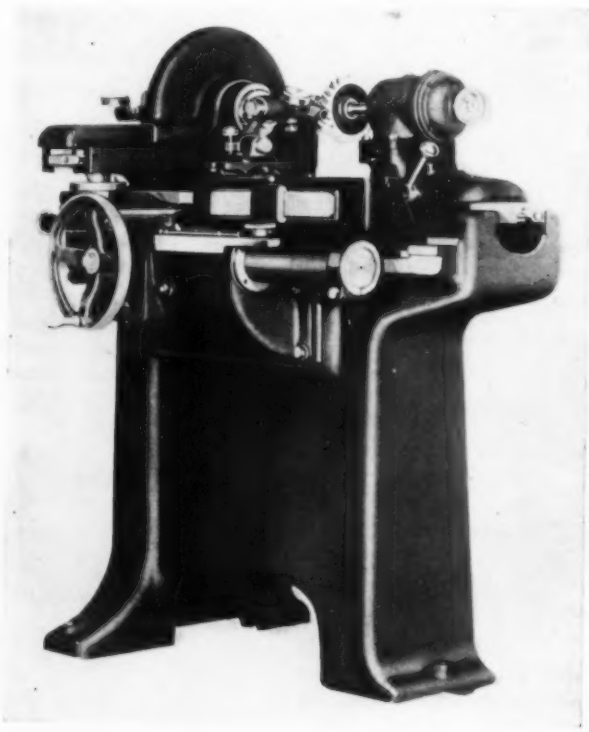
The gear is mounted between centers in machine. An adjustable-tooth contactor connected to a direct-reading 0.0001-in. indicator is mounted on carriage at front of machine. This carriage also carries an angularly adjustable straight-edge, and is traversed on bed parallel to the head and tailstock centers. The headstock is provided with a spindle mounted on self-adjusting precision ball bearings. This spindle also carries a ground and calibrated involute cam. The headstock is further provided with a transverse cross-slide, one end of which mounts a fully adjustable roller that maintains contact with the involute cam on the spindle. The other end of this cross-slide is provided with adjustable shoes or contact members that engage the angularly adjustable straight-edge mounted on the indicator carriage. Angular adjustment of the straight-edge is set according to the lead of the gear being tested.

In operation the tooth contactor is adjusted into position with one of the gear teeth. The indicator carriage is traversed parallel to the gear axis by means of a handwheel at the front of the machine. As the indicator carriage is traversed, carrying with it the angularly adjusted straight-edge, the transverse cross-slide carried by the headstock is caused to move at right angles to the work spindle. This movement causes the roller mounted on the cross-slide and in engagement with the involute cam to rotate the spindle and gear being tested. Thus, straight-line motion of the indicator is converted into rotary motion of the spindle and gear. Any deviation from true lead of the gear is registered directly on the direct-reading indicator in 0.0001 in.

To insure that the indicator reading is a true representation of the deviation from theoretical, provision has been made in the machine for an accurate calibration of the rotary motion of work spindle relative to a known distance traversed by the contactor in engagement with the gear tooth. It is not considered sufficient with the delicate measurements being made to assume that the angular adjustment of straight-edge will insure correct and accurate readings. To overcome any possibility of error in machine settings, a method has been provided for checking the angular rotation of work spindle and the linear distance traversed by the tooth contactor. The rear of work spindle has been provided with an accurately ground index plate engageable by a direct-reading 0.0001-in. indicator. On the front of bed, there is provided a V-block in which an adjustable stop is located. This stop may be located in a number of positions in the V-block. The front of indicator carriage is provided with an adjustable holder on which is mounted another 0.0001-in. indicator.

After the straight-edge on indicator carriage has been adjusted according to the lead of gear being tested, the indicator engaging the index plate on the rear of the work spindle is swung into position in engagement with one of the notches of index plate and indicator dial set to zero. A set of precision gage or measuring blocks is then placed in position in the V-block at front of machine with one end thereof positioned against the stop. The indicator at front of carriage is then adjusted to bear against the other end of the gage blocks with indicator dial set at zero. The indicator engaging the index plate at rear of work spindle is now swung out of position and the gauge or measuring blocks removed from machine. The work spindle and index plate are caused to rotate through an angular distance of one or more divisions, checking this by swinging the indicator back into position. The distance traversed by indicator carriage and tooth contactor is now checked by again reinserting measuring blocks in V between stop and indicator at front of carriage. Since the index plate at rear of work spindle is provided with twenty divisions, the linear movement of tooth contactor can be checked, if thought desirable, for each twentieth of the length of lead.

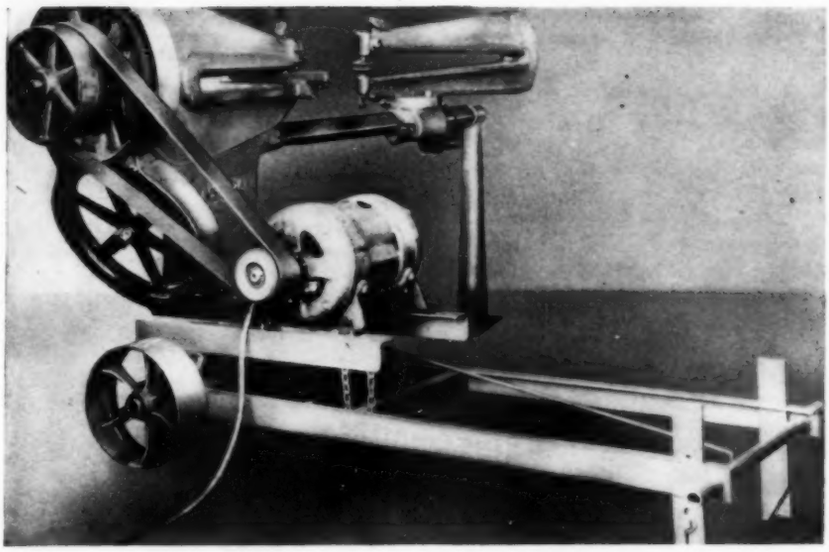
Thus it will be seen that the machine not only accurately checks the lead, or helix angle of helical gears, but also may be accurately calibrated before such test is made.



Lees-Bradner Helical-Gear Lead Testing Machine which will measure the helix angle or lead of helical gears, and which is provided with means to calibrate the machine settings

Rockwood Industrial Truck With Utility Motor

A portable truck carrying a motor is being offered by the Rockwood Manufacturing Co., Indianapolis, Ind., for use in driving industrial machinery when the machine motor breaks down or needs



When a machine motor fails, this Rockwood Industrial Truck with utility motor can be wheeled into position for quick resumption of operation

repairs. The truck can be wheeled into position and the machine made ready to run in 5 min. The truck consists of a standard Rockwood drive made as part of the truck. Alignment of the motor and driven pulleys can be quickly secured and no cutting of the belt is required. Units of this sort will accommodate practically any make of electric motor or gas engine weighing up to 400 or 500 lb. Front and rear stops and stakes assure solid footing so that the truck can be locked in position and will not creep or crawl when drive is running.

"Parkson" Universal Gear Testers

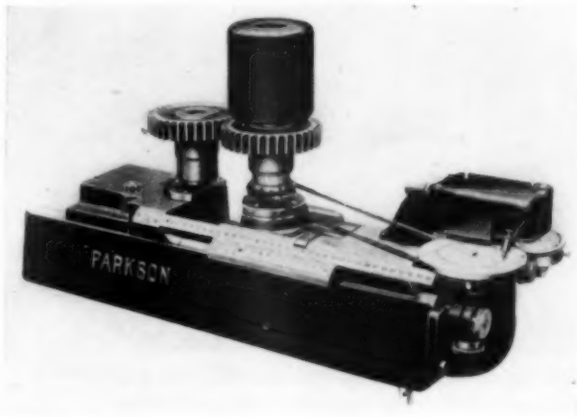
George Scherr Co., 128 Lafayette St., New York, N. Y., is introducing in the United States the "Parkson" universal gear testers made by J. Parkinson & Son, Shipley, England. With these machines it is said a test can be made under practically the same as operating conditions, and the test will quickly show whether a pair of gears will run silently and properly or not. These equipments are available in three different sizes as universal equipment for spur gears, spiral gears, bevel gears, as well as worm gears and worms. They may be used either with a dial indicator for quick visible check, preferably near the gear cutting machine to make sure that the set-up is correct; or they can be equipped with a recording device for the automatic production of a permanent record on a circular chart.

The gears are tested in pairs. Although not necessary, it is recommended that one of the pair should be a templet gear. Both are mounted to revolve freely on arbors. One arbor is fixed in a carriage which is mounted on slide ways on the bed and clamped in the desired position. The other arbor is carried by a floating carriage which has a limited movement longitudinally on the bed and rolls on three steel balls. At one end of the floating carriage is a spring plunger. The exact distance between the centers may be read from the scale and vernier, and variations of the center distance or movements of the floating carriage caused by defects on the teeth or eccentricity with the bore may be noted on the dial indicator.

With a pair of gears mounted on the arbors, the adjustable carriage is moved to bring the teeth of the gears in contact and is then clamped to the bed. The adjusting screw at the end of the bed is then regulated to give the desired pressure to the floating carriage, the spring plunger holding the teeth in close mesh. Center distance of spur or spiral gears may be read on the scale and vernier, and the gears may be rotated to judge the freedom and smoothness of the rolling action. If the floating carriage is not fixed by the regulating screw, but is only acted upon by the gear teeth on one side and the spring plunger on the other side, it will be found that as the gears are rotated, slight movements are imparted to the floating carriage. The extent of these movements determines the value of the gears, and they are shown on the dial indicator at the end of the bed. The indicators are furnished to read to 0.001 in. or 0.01 m m. The indicator shows immediately the effect of a thick tooth in one of the wheels, how bad tooth forms produce a jumpy or jerky action, when a wheel blank has not been mounted concentrically for cutting, and also the extent of the error.

The regulating screw which acts opposite to the plunger may be brought into action to show a movement of one or more thousandths of an inch on the dial indicator, until the scale and vernier show the correct reading for center distance. This will enable the gears to be rotated in working position. When thus tried there should be no movement of the dial. If there is such movement, the teeth require cutting deeper, or reducing the addendum. If the dial movement is at one part of the rotation only, either there are some bad teeth or the teeth are not concentric with the bore.

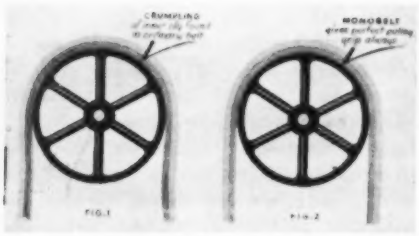
The machine can be used for testing the accuracy of turning of gear blanks before the teeth are cut.



"Parkson" Universal Gear Tester for spur gears from 1½ to 9 in. between centers. This model is equipped with a recording device

"Monobelt" Leather Belting

A general utility belting for all regular drives, known as "Monobelt," has been developed by Alexander Bros., Inc., Philadelphia, Pa. Since high-speed motor drives usually require a small-diameter pulley running at high speed, the area of contact between belt and pulley is considerably reduced, and the belting is subjected to sharp and frequent bends that cause internal friction. Therefore, in belting for present-day, high-speed drives there are three objectives to be attained: (1) Increase



Diagrammatic sketches showing crumpling of ordinary belt on pulley and full contact of "Monobelt" for even distribution of internal stresses

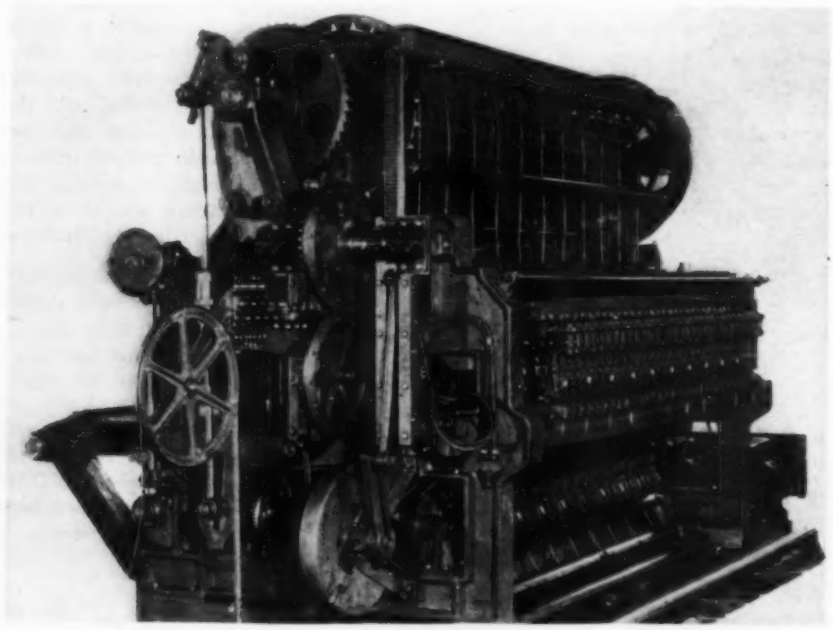
of adhesion to compensate for the small area of contact; (2) reduction of stretch to compensate for excessive elongation as the result of the belt being sharply bent over a small pulley at high speed, and (3) reduction of internal friction to increase belt life efficiency in horsepower capacity and to minimize mechanical resistance. For "Monobelt" there is selected a vegetable-tanned leather having high adhesion and being thoroughly stretched by a special process. In single-ply belts, leather with a minimum of stretch is used. In double-ply belts the pulley side of the belt is made of the same leather as the single-ply, but the outer ply is made of more elastic leather. With such construction the internal friction is considerably reduced.

As shown in Fig. 1 in an ordinary double-ply leather belt the outer ply is subjected to an excessive tension and the inner side is crumpled. In Fig. 2 is shown a "Monobelt" in which the inner ply is in full contact with the pulley while the internal stress is evenly distributed over the belt material. This belt is made in only one standard thickness for each width, the thickness increasing with the width, on the principle that narrow belts are usually employed on small-diameter pulleys where a thin belt is usually proper, whereas wider belts are used on larger diameter pulleys where a heavier belt is in order.

Thomson-Gibb Automatic Welding Machine for Road-Reinforcing Mats

An automatic welding machine has been designed by the Thomson-Gibb Electric Welding Co., Bay City, Mich., to produce welded mats for road-reinforcing and also other steel fabrics. The machine handles rods or wires of any size from ½ in. down. Longitudinal and cross wires are fed directly from reels except when the cross wires are heavier than No. 2. Heavy cross wires and rods, straightened and cut to size in advance, are fed automatically from a magazine. Cross and longitudinal spacing is fully adjustable.

The welded mats are delivered either flat or reeled to suit the weight of the fabric and can be slit automatically by the machine to make strips of two widths at the same time. The machine makes 32 or more welds at one time and produces as much as 60 tons of welded fabric in a 10-hour day. Other models are available for the heaviest kinds of bar mats.



As many as 32 welds, or more, are made at once on this machine for fabricating road-reinforcing mats or other steel fabric

Haskins High-Speed Tapping Machine

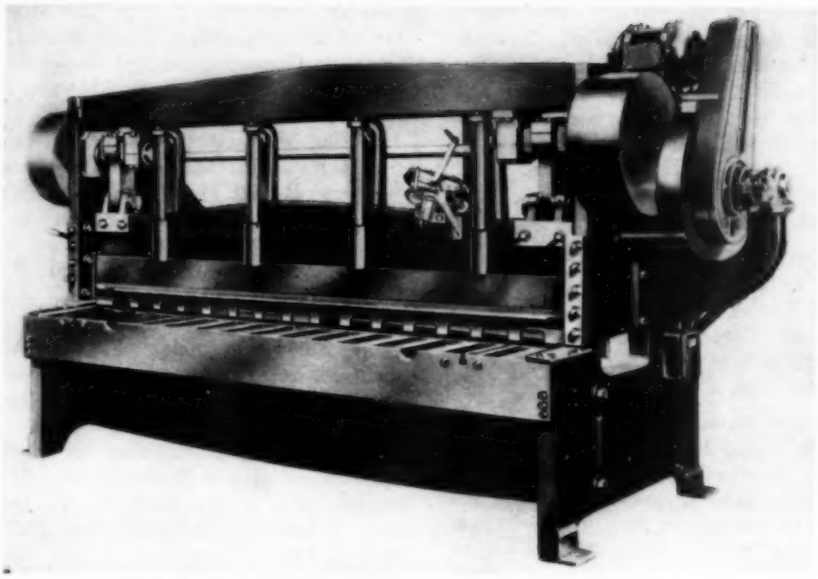
A tapping machine capable of speeds up to 3,000 r.p.m. is now available from the R. G. Haskins Co., 4636 West Fulton St., Chicago, Ill. The motor in the tapping head is of the repulsion-induction type and is full ball bearing equipped. The head is held in position

by a wedge lock, permitting quick change of gears. Two high speeds are provided. There is no float in the tap spindle and instant reverse may be had at double the tapping speed. Five collets are furnished as standard.

The table is adjustable for different heights of work. Stops are arranged for vertical travel of the tapping head, the maximum travel being 3 in. Vertical and side-to-side adjustment is secured by quick acting wedge lock. The vertical shaft bearings are line-reamed and lapped. Tapping capacity of the machine is ¼ in. in non-ferrous metals and $\frac{3}{16}$ in. in steel.

Chicago Steel Power Shear With Back Gage

High-speed cutting with greater accuracy is secured on the "Chicago" steel power shear by having the back gage operated from the front of the machine. The convenience of setting this back



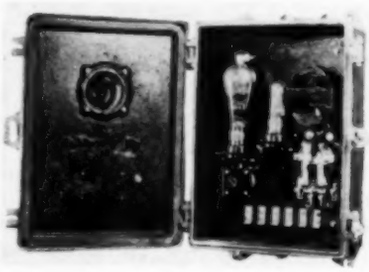
The back gage on this Chicago shear is operated from the front for greater accuracy and production

gage from the front results in considerable saving of time. The illustration shows the operating crank of the gage and the dial, which is graduated in inches and sixty-fourths of an inch. Dial graduations are double scale so that accurate reading is quickly made. Both screws are operated in unison, keeping the gage in parallel alignment with the knife at any position. The gage automatically locks at any setting. Gage screws can be disconnected for taper cutting.

Other features of this machine are the low-cutting angle of the upper blade, the high-pressure hold-down and the rigid construction. Individual hold-down fingers can be specified if desired. The shear is of steel-plate construction. Is manufactured by the Dreis & Krump Mfg. Co., 74th St. and Loomis Blvd., Chicago, Ill.

Westinghouse Type RK Photo-Troller

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has placed on the market a Type RK "Photo-Troller" adapted to industrial light-sensitive applications requiring operation on low-light intensity. The indoor model operates on three footcandles with the phototube extended at distances up to 10 ft. The unit will operate on as little as ½ footcandle with a pickup lens. Combined with standard light sources the unit will cover up to a 50-ft. throw.



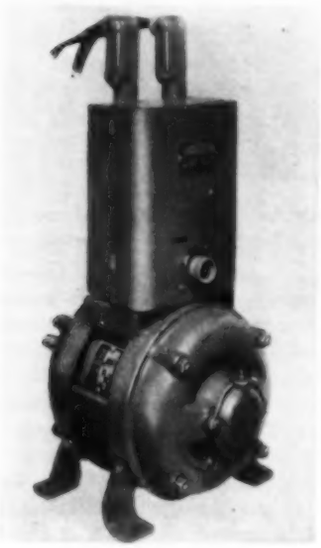
Metzgar Light-Duty Truck and Caster Wheels

The Metzgar Co., Inc., Grand Rapids, Mich., has added to its line of end-wood, protective-tread wheels and casters a light-duty type having either end-wood bearings or ball bearings. These wheels are built up of a number of hard maple wedges. Diameters range from 2½ to 10 in., inclusive. Any thickness of face, hub-length and bore for the axle can be supplied without extra charge. Wheels within this range of sizes can be supplied for standard axles fitted with ball bearings at a slight additional charge.

Metzgar Light-Duty Truck Wheel fitted with a ball bearing for standard axle

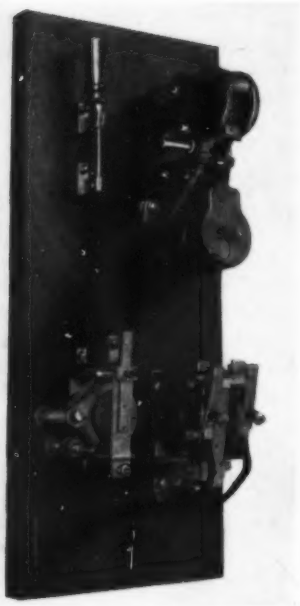
Lincoln Self-Protected Motor

The Lincoln Electric Co., Cleveland, Ohio, has developed a self-protected motor that cannot burn out. A protective device is built into the windings. This device shuts off the current should the machine become stalled through overloading, excessively hot because of poor ventilation or run on single-phase. The sizes built range from ½ to 30 hp. in a.c. induction types for either 2- or 3-phases and standard commercial cycles and voltages. Controls are mounted on the motor.



Harnischfeger Relay for Crane Operations

Increasing the lowering speed of the hoist drive without reducing the safety factor or minimizing the accuracy of control is claimed for the high-speed lowering relay developed by the Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis. The common practice of supplying d.c. motor-operated cranes with dynamic lowering control means that with light load or no load at all the hoist motor must drive the hook downward. Since the average load handled by most industrial cranes runs about one-third of capacity or even less, it is desirable to establish means for lowering at greater speeds that more nearly equal the light-load hoisting speeds. The device illustrated has been developed with



On light loads this Harnischfeger Crane Relay affords greater lowering speeds

that purpose in mind. It is automatic and is controlled only by the weight of the load itself. When the load is heavier than about one-third capacity the relay automatically prevents the speed increase. This high-speed lowering relay can be applied to any d.-c.-motor-operated crane equipped with a series motors and dynamic lowering control. It requires no serious alteration in the main controller and crane wiring. It is available for any size of hoist motor operating on 110 to 550 volts.

• TRADE • PUBLICATIONS

FILE AND SAW MANUALS. Henry Disston & Sons, Inc., 3220 Tacony, Philadelphia, Pa., has published a series of manuals on metal cutting files, inserted-tooth saws, solid-tooth saws, Carboloy products, hacksaw blades and band saws. Each of these manuals give information on selection and care of the particular tool, dimensions, shapes and uses.

FURNACE INSULATION. Johns-Manville, 22 East 40th St., New York, N. Y., show in a 72-page booklet insulation methods for industrial furnaces and ovens. The requirements for each particular type of heated equipment are analyzed and detailed recommendations are made accordingly.

INSTRUMENTS. Catalog G, Part 2, issued March, 1934, by the General Radio Co., Cambridge A, Mass., shows stroboscopes for testing machinery.

INSULATING MATERIAL. The Continental-Diamond Fibre Co., Newark, Del., has issued a pamphlet showing the various forms in which "Micabond" insulating materials are available. These materials use bonded mica in sheets, plates, paper, cloth, tubing and other forms. Information on machining is included.

MOTORPUMPS. Catalog No. 7464, issued by Ingersoll-Rand Co., 11 Broadway, New York, N. Y., shows the 26 sizes of "Cameron Motorpumps" built in ratings from ¼ to 30 hp. and in capacities from 5 to 1,000 gpm.

PILLOW BLOCKS. Bulletin No. 934-A, issued by the Norma-Hoffman Bearings Corp., Stamford, Conn., illustrates ball- and roller-bearing pillow blocks, shows machine mountings and flange mountings adapted for various machine assemblies.

POWER TRANSMISSION. The Mechanical Power Engineering Associates, 684 St. Marks Ave., Brooklyn, N. Y., has published a booklet giving facts concerning the economical use of power and graphically presenting a study of power transmission costs under a wide variety of conditions. The booklet purports to show that investment in any program of modernization can be reduced by the use of group drive, rather than unit drive.

STEELS. Information on the physical properties and heat-treatment of "Hymo" 0.30-0.40 carbon steel is contained in circular issued by the Union Drawn Steel Co., Massillon, Ohio.

ZINC. "Planning-Making-Selling-Design for Profit," a publication of the New Jersey Zinc Company, 160 Front St., New York, N. Y., discusses the advantages of zinc, gives the properties of zinc die-castings and shows the importance of knowing the properties of the material for effective design and selling of many products.

• PATENTS •

MARCH 6, 1934

Metal-Working Machinery

Metal Bending Machine. James C. Baldwin and Chad C. McKnight, Enid, Okla. Patent 1,949,401.

Lathe for Rapidly Finishing a Rotary Work Surface. Charles H. Norton, Plainville, Conn., assigned to Norton Co. Patent 1,949,512.

Machine for and Method of Lapping the Ends of Round Work Pieces. Francis William Elstub, Coventry, England, assigned to Norton Co. Patent 1,949,514.

Hydraulic Wheel Feeding Mechanism. Herbert A. Silven, Worcester, Mass., assigned to Norton Co. Patent 1,949,516.

Gear-Cutting Machine. Robert Merkel, Chemnitz, Germany, asigned to J. E. Reinecker, A. G., Chemnitz, Germany. Patent 1,949,546.

Grinding Machine. Edward M. Taylor and Ralph A. Quimby, Worcester, Mass., and Robert M. Lippard, Detroit, Mich., assigned to the Heald Machine Co. Patent 1,949,552.

Variable Speed Grinder. Paul B. Reeves, Columbus, Ind., assigned to Reeves Pulley Co. Patent 1,949,975.

Tool Slide Positioning Mechanism. Edwin R. Smith and Albert Schinkez, Seneca Falls, N. Y., assigned to Seneca Falls Machine Co. Patent 1,950,039.

Work-Handling Mechanism for Machine Tools. Edwin R. Smith and Albert Schinkez, Seneca Falls, N. Y., assigned to Seneca Falls Machine Co. Patent 1,950,040.

Safety Guard for Punch Presses. Paul A. Eriksen, Philadelphia, Pa. Patent 1,950,233.

Hydraulic Actuating Means for Lathe Slides. Paul von Pechmann, Cologne, Germany. Patent 1,950,332.

Tools and Attachments

Drawing Press Mechanism. Antone Bertucci, San Jose, Calif., assigned to American Can Co. Patent 1,949,407.

Grinding Wheel. Wallace W. Greenwood, Worcester, Mass., assigned to Norton Co. Patent 1,949,513.

Device for Measuring Workpieces. Rudolf Geh, Berlin - Charlottenburg, Germany. Patent 1,949,795.

Processes

Method of Turning and Grinding Round Work Surfaces. Charles H. Norton, Plainville, Conn., assigned to Norton Co. Patent 1,949,515.

MARCH 13, 1934

Metal-Working Machinery

Grinding Machine. Roger N. Heald, Worcester, Mass., assigned to the Heald Machine Co. Patent 1,950,491.

Multiple Spindle Grinder. Edwin R. Smith and Albert Schinkez, Seneca Falls, N. Y., assigned to Seneca Falls Machine Co. Patent 1,950,524.

Transmission Mechanism for Machine Tools. Benjamin P. Graves, Cranston, and Arthur F. Bennett, West Barrington, R. I., assigned to Brown & Sharpe Manufacturing Co. Patent 1,951,146.

Tools and Attachments

Inserted Blade Cutter. Frank P. Miller and John Arthur Spohr, Meadville, Pa., assigned to McCrosky Tool Corp. Patent 1,951,100.

Inserted Blade Cutter. Frank P. Miller, Meadville, Pa. Patent 1,951,101.

Ejector for Power Presses. Edmund W. Zeh, Newark, N. J. Patent 1,951,229.